

EXHIBIT 1



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Kim et al.

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(45) Date of Patent: **Dec. 24, 2002**

(54) **PORTABLE COMPUTER AND METHOD FOR MOUNTING A FLAT PANEL DISPLAY DEVICE THEREON**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days

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(21) Appl. No.: **09/444,376**

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(30) Foreign Application Priority Data

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Oct. 27, 1998	(KR)	98-44973

(51) Int. Cl.⁷ **G06F 1/16**

(52) U.S. Cl. **361/680; 361/683; 361/686; 349/58**

(58) Field of Search **361/679-681, 361/683, 686; 349/58**

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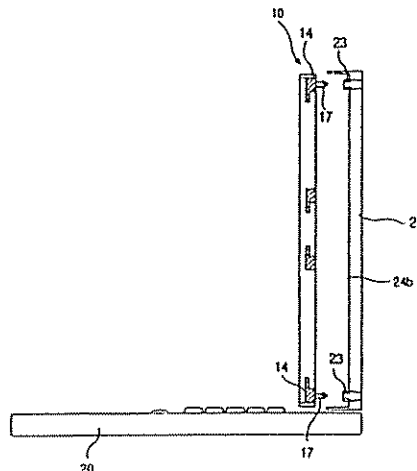
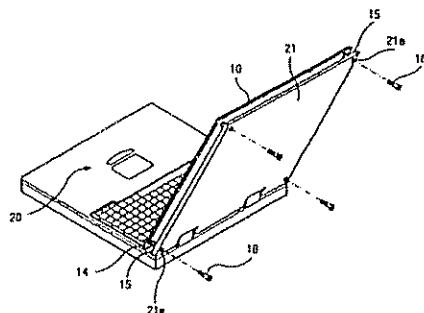
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(57) ABSTRACT

A portable computer including a housing having first and second sections, the first section having an information input device and the second section having a case having a first fastening element; a display panel including a second fastening element at a rear surface of the panel, the case and the display panel being attached through the first and second fastening elements; a hinge coupling the first and the second sections to each other; and a display panel support member having a third fastening element, the display panel support member being attached to the display panel through the third fastening element.

41 Claims, 16 Drawing Sheets

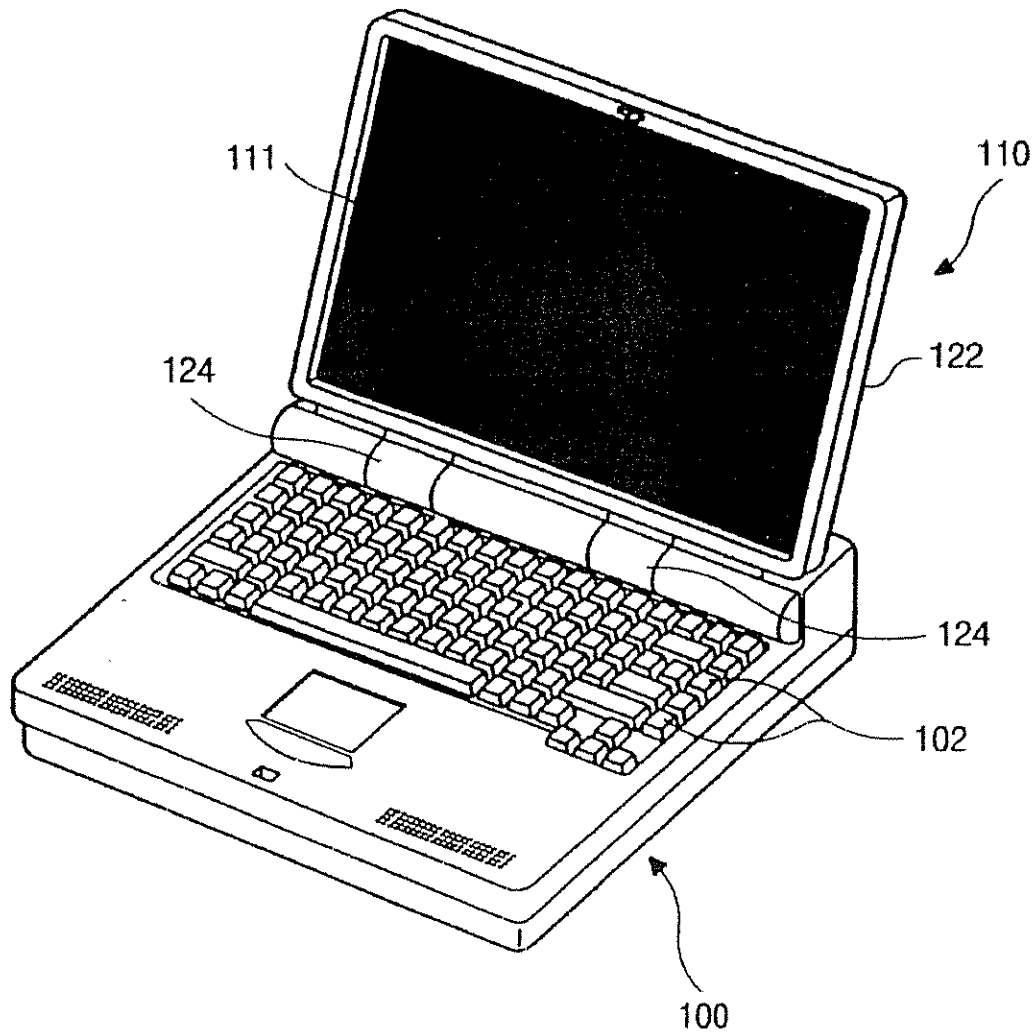


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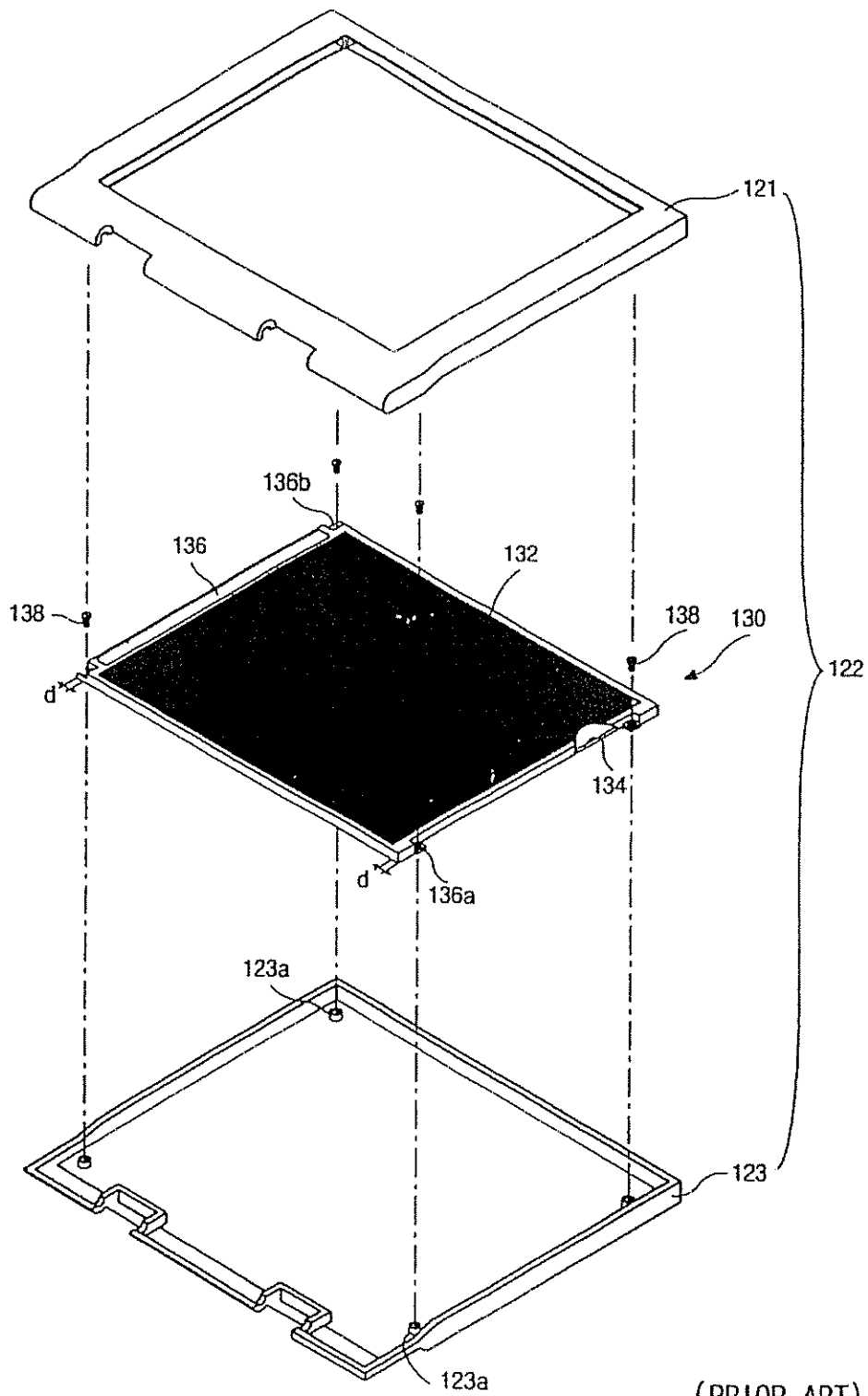
(PRIOR ART)
FIG. 1

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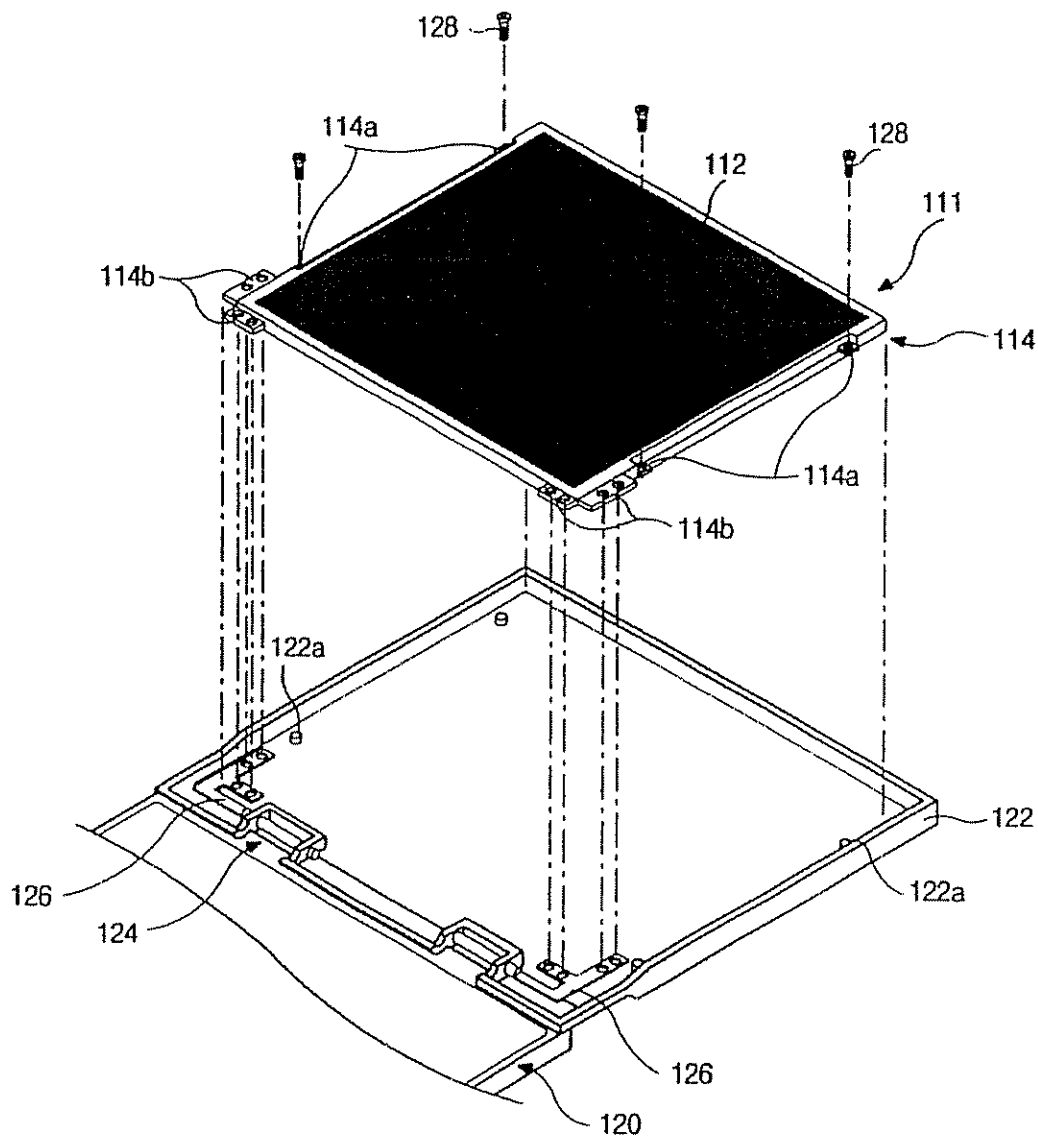
(PRIOR ART)
FIG. 2

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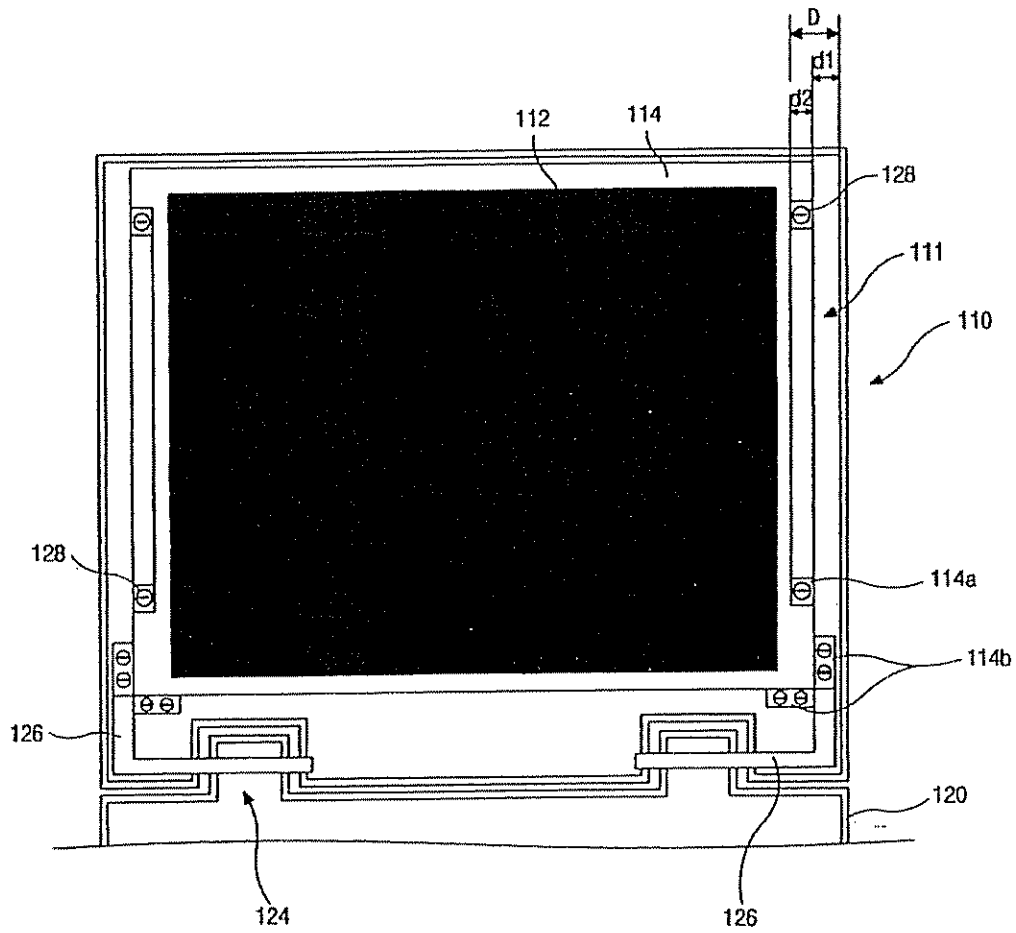
(PRIOR ART)
FIG. 3A

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(PRIOR ART)

FIG. 3B

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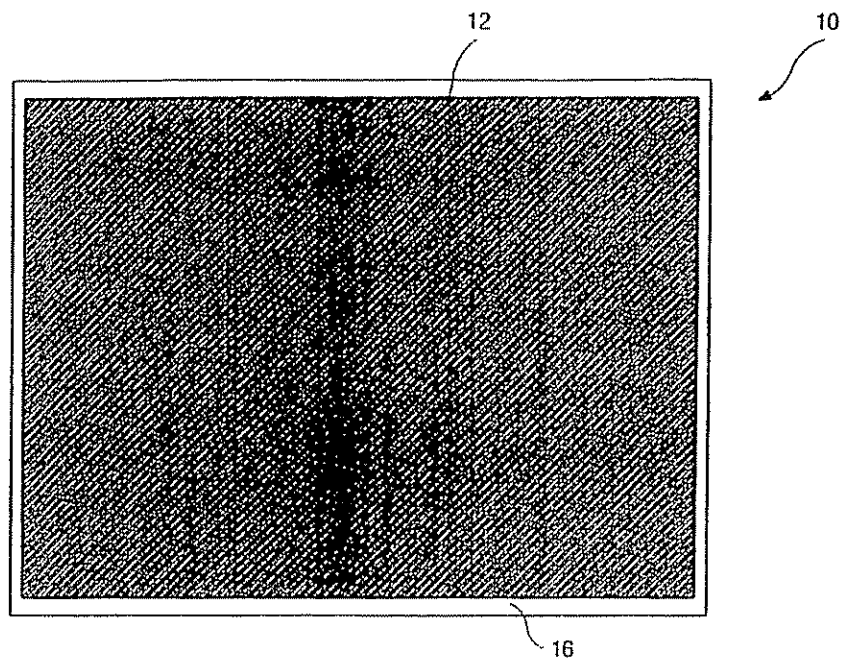


FIG. 4A

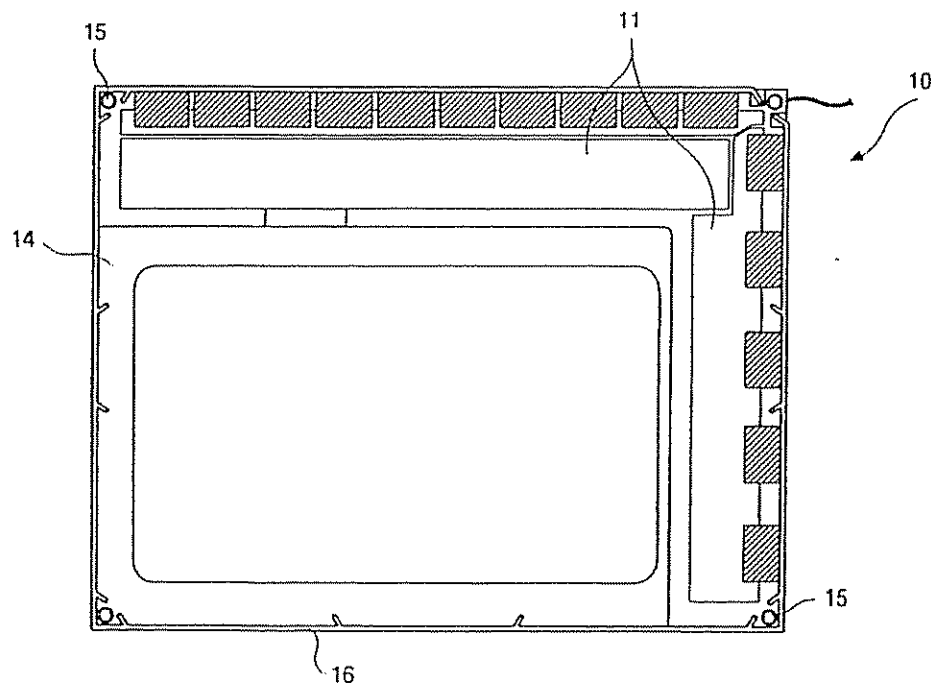


FIG. 4B

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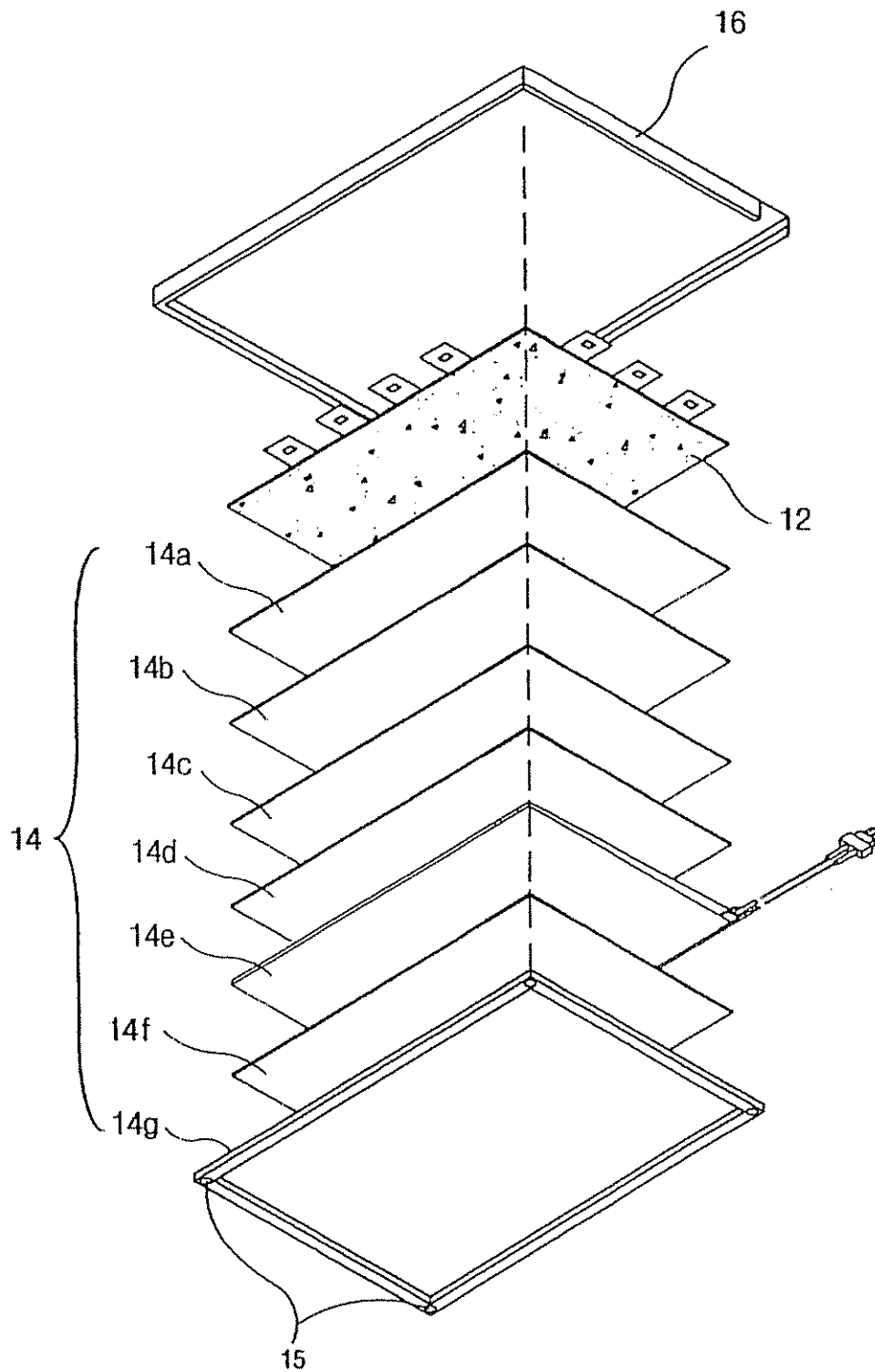


FIG. 4C

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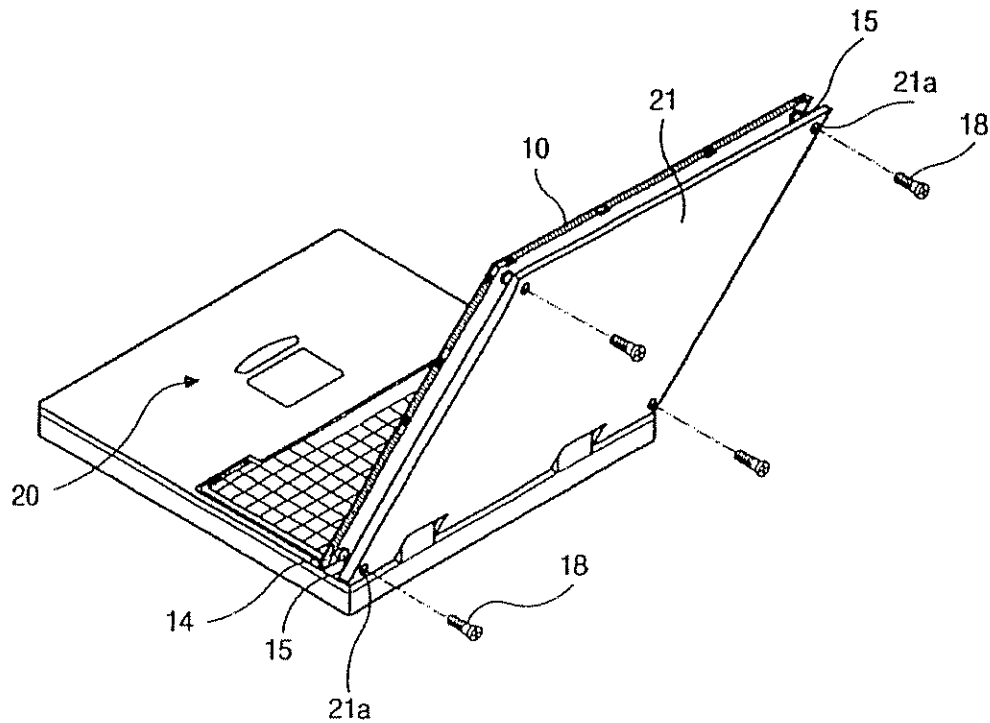


FIG. 5

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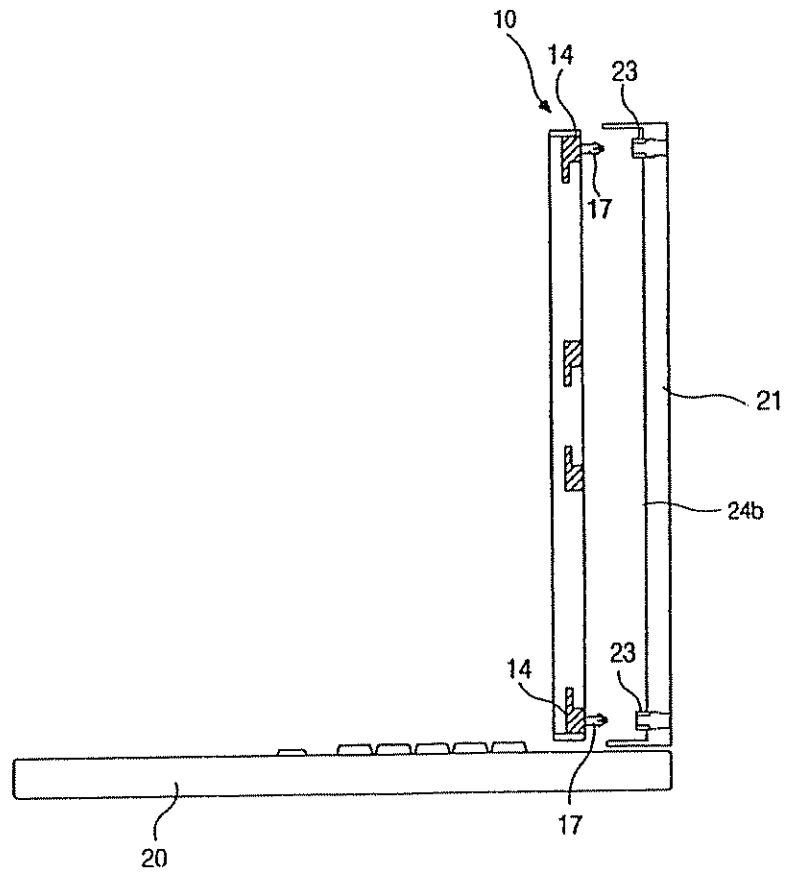


FIG. 6

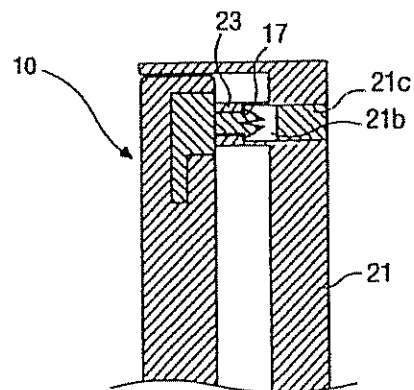


FIG. 7

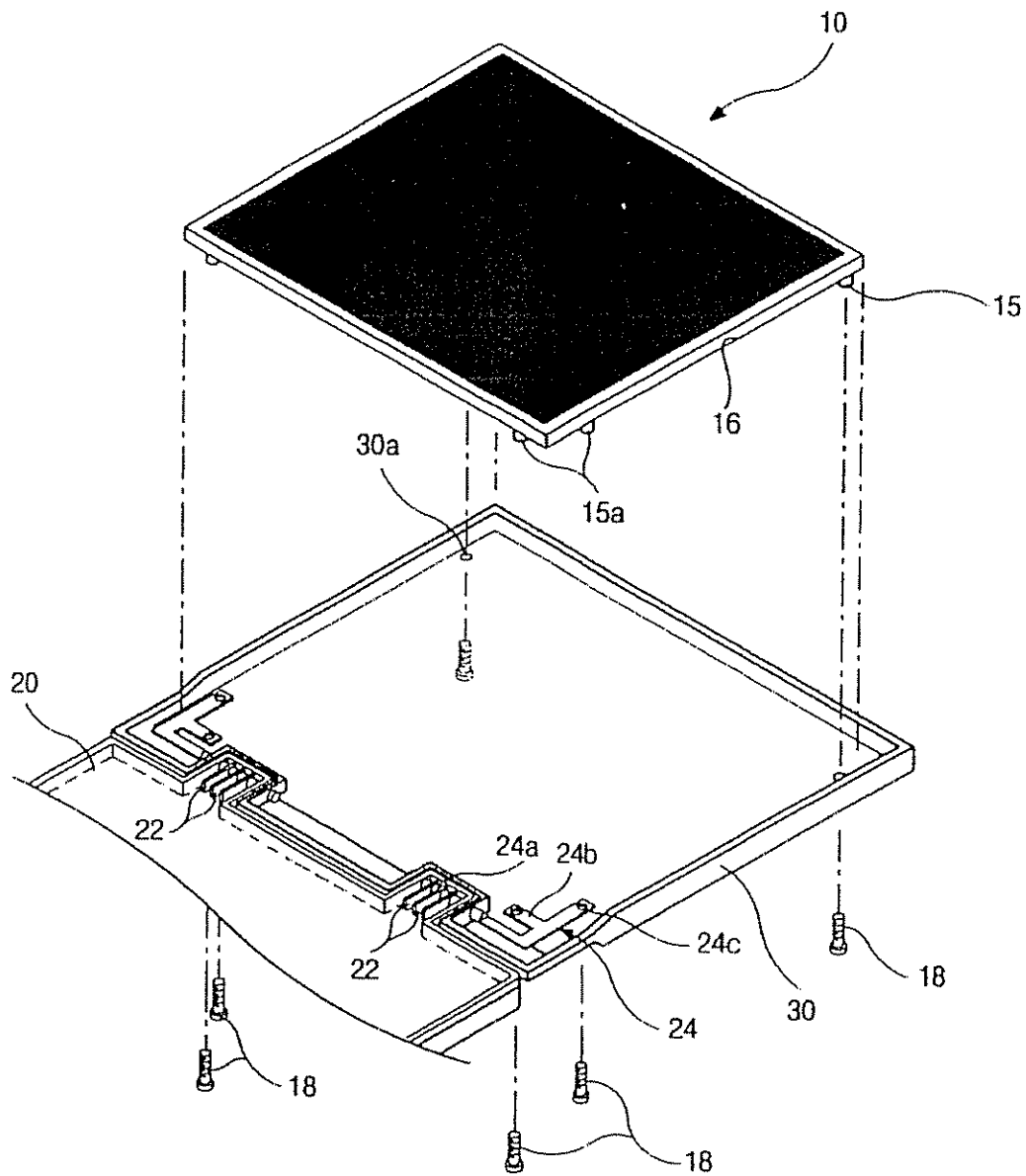


FIG. 8

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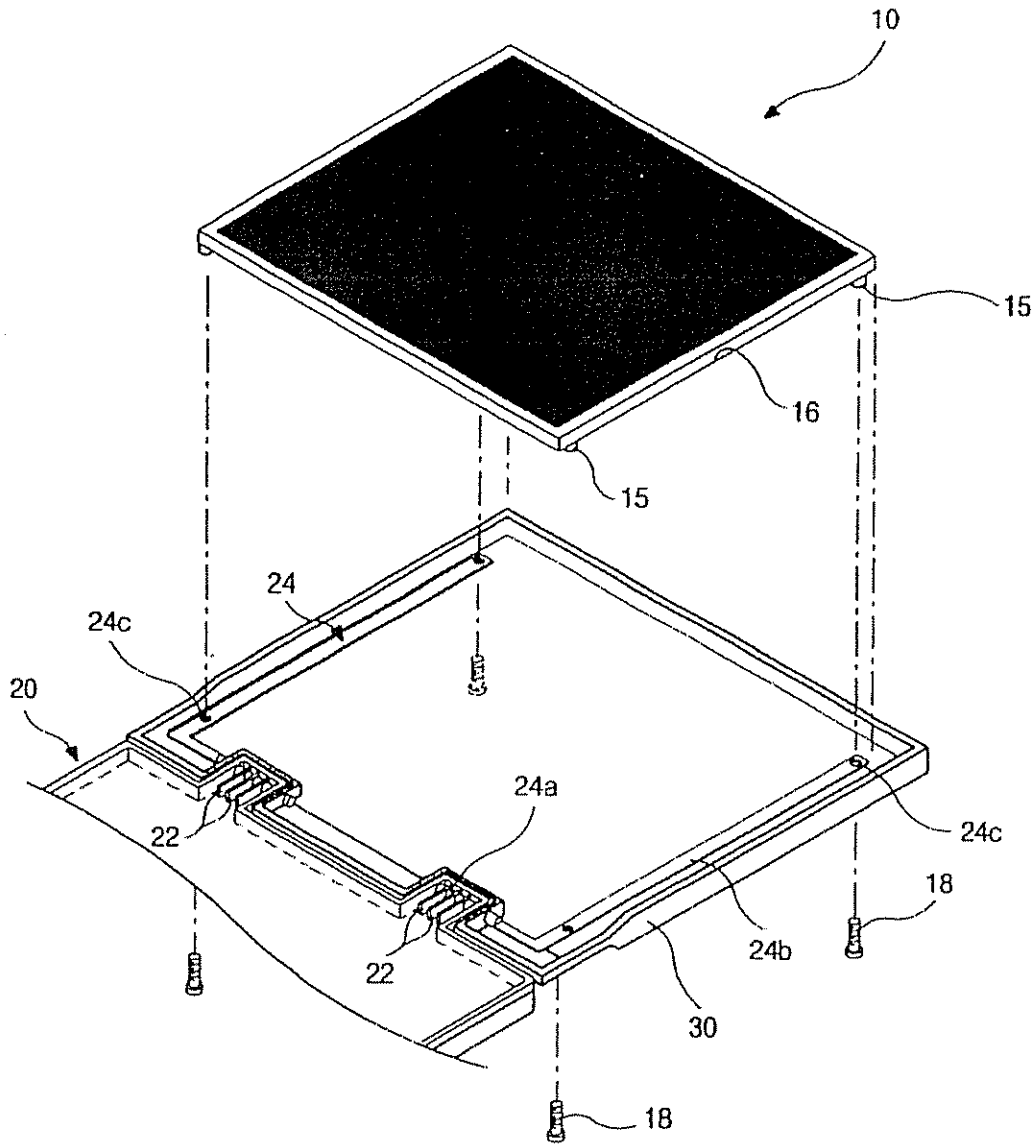


FIG. 9

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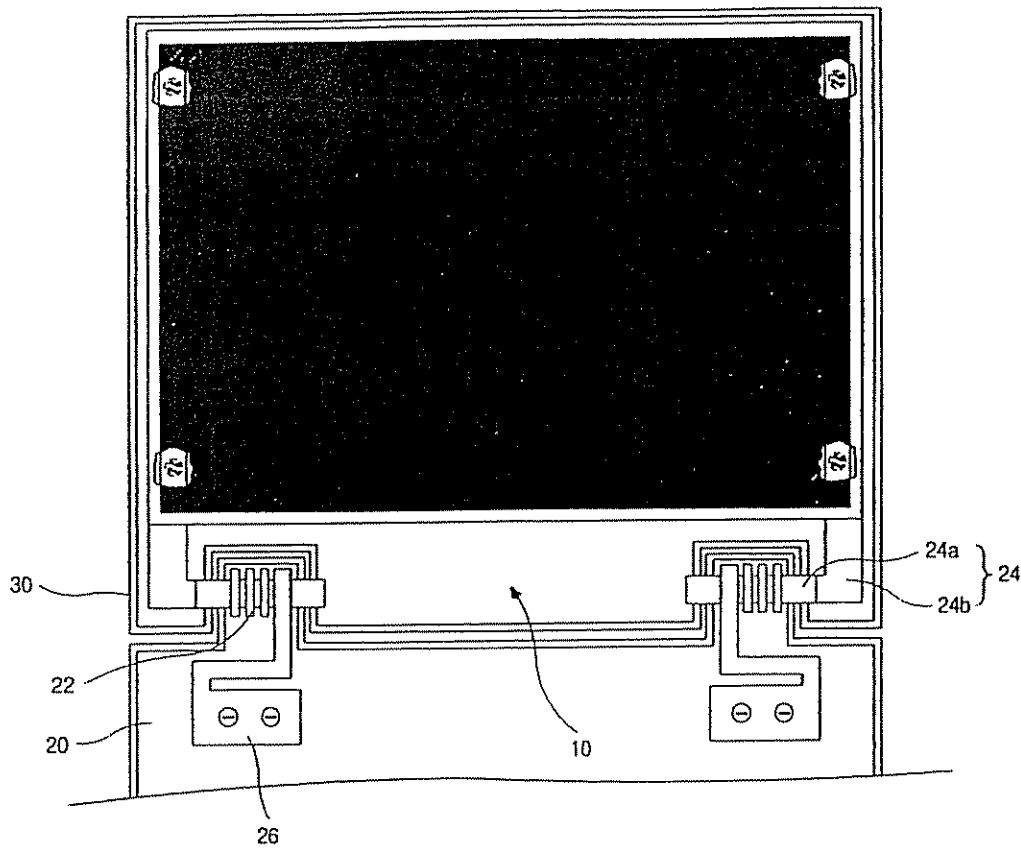


FIG. 10

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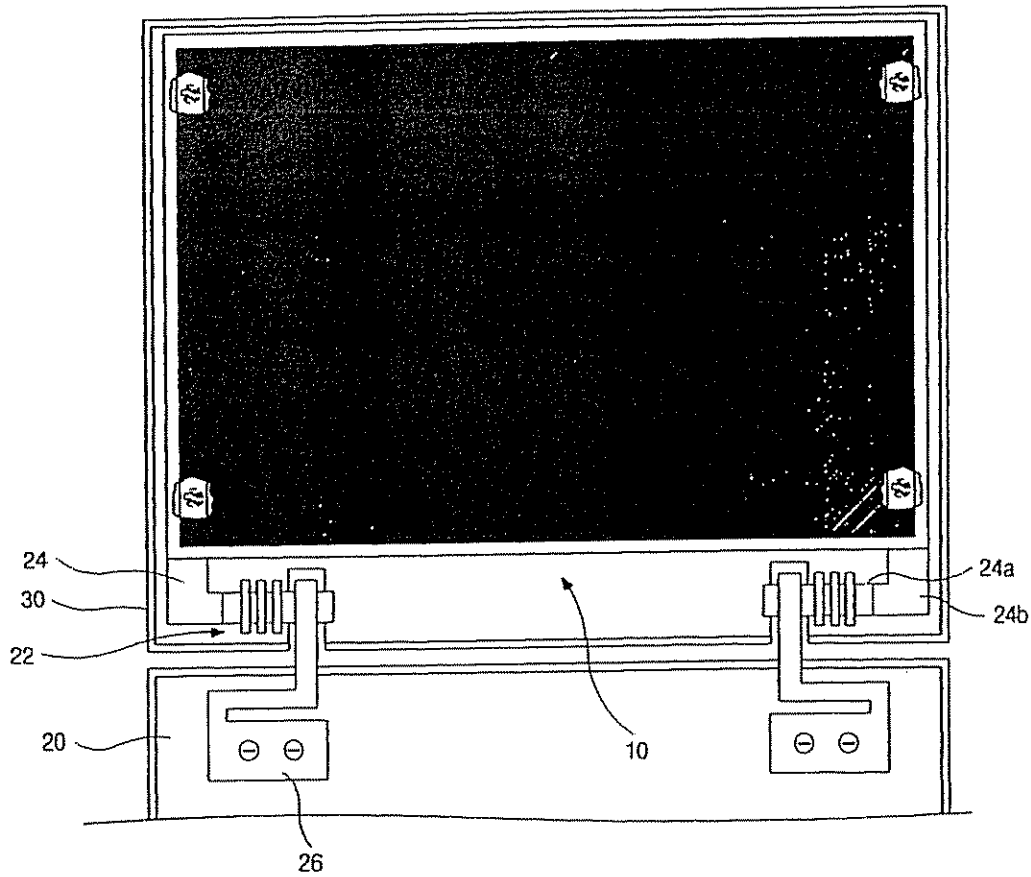


FIG. 11

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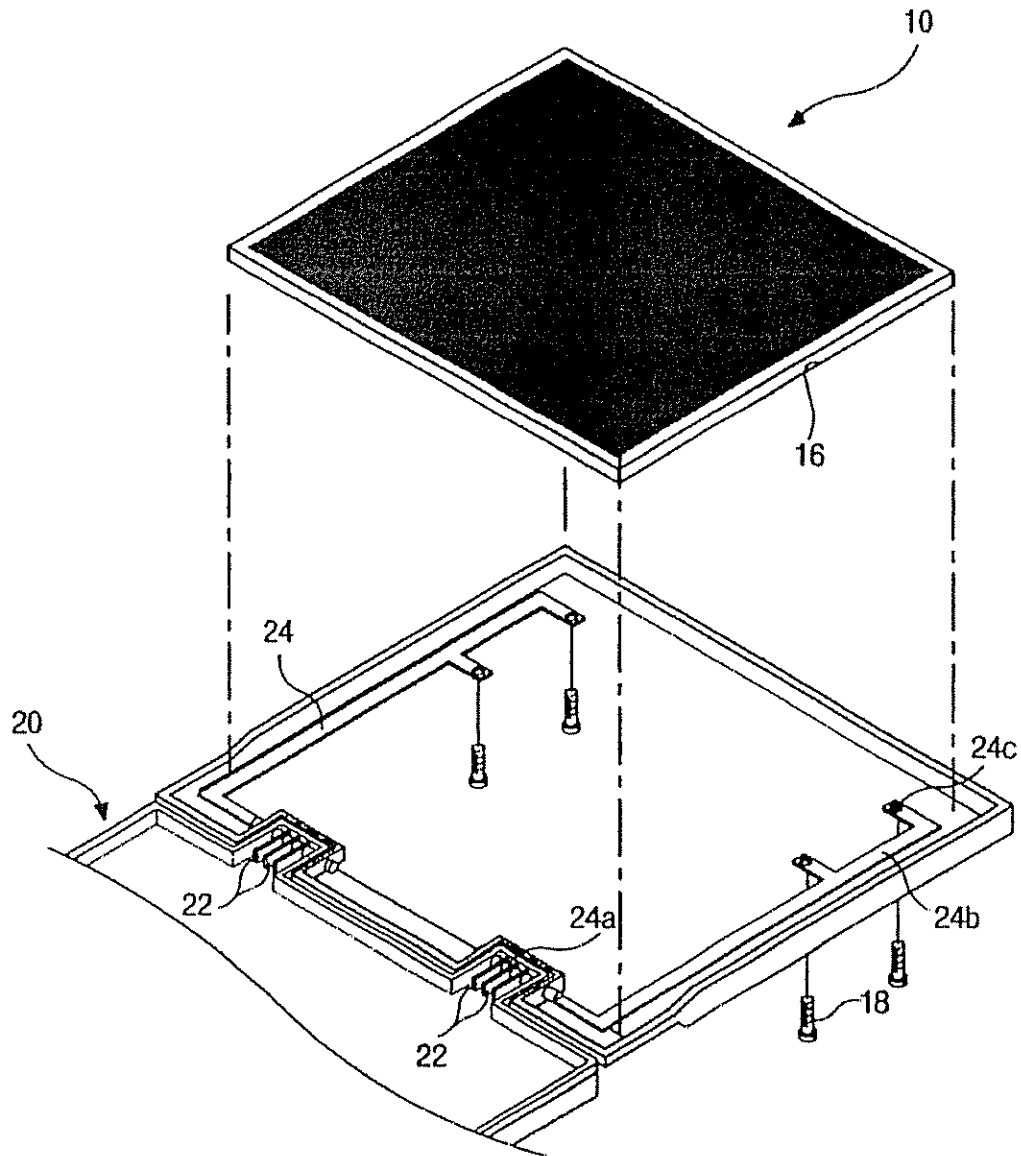


FIG. 12

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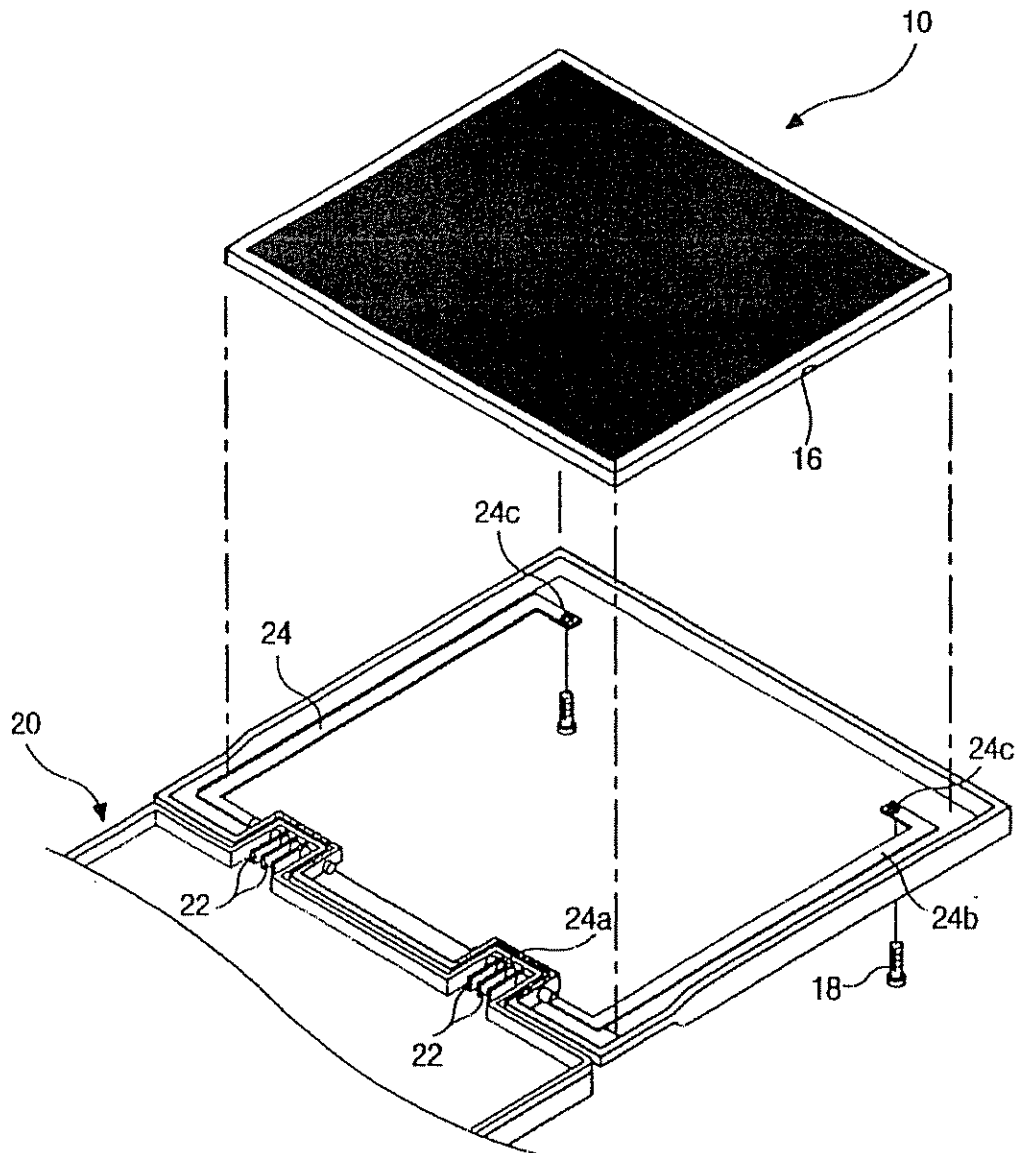


FIG. 13

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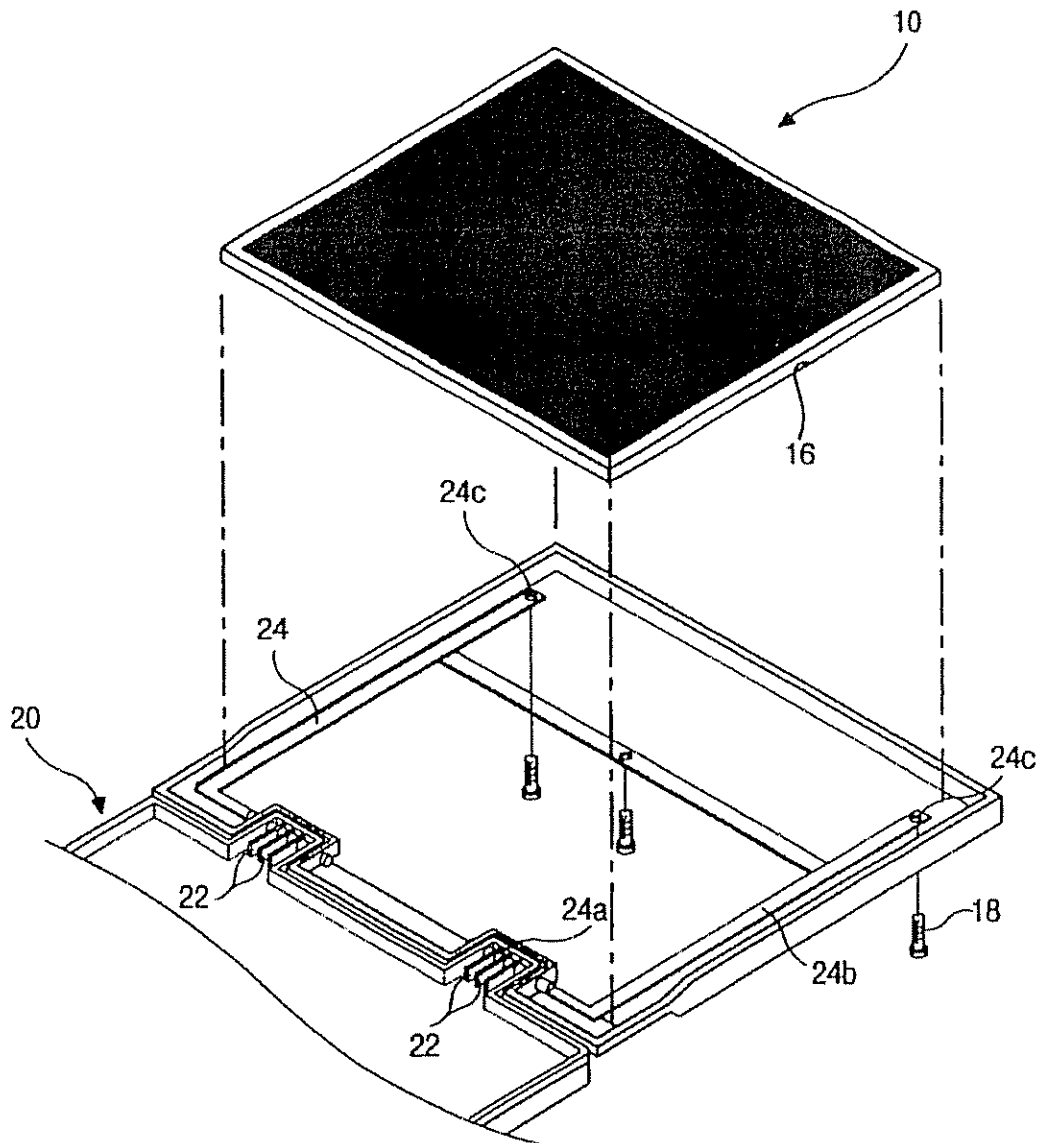


FIG. 14

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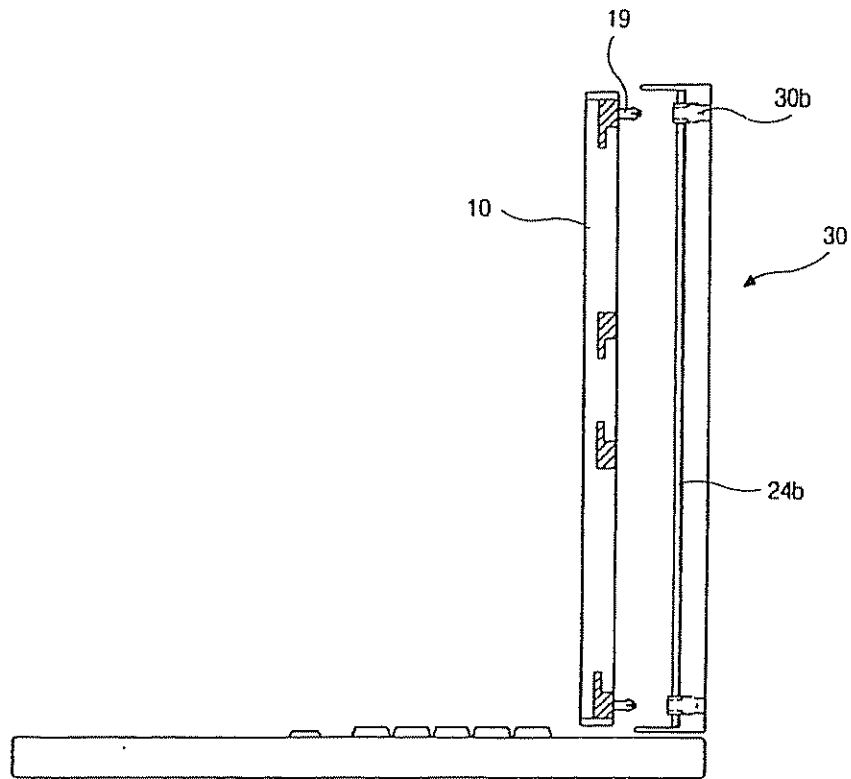


FIG. 15

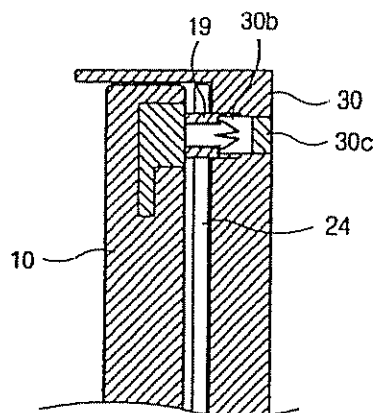


FIG. 16

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PORTABLE COMPUTER AND METHOD FOR MOUNTING A FLAT PANEL DISPLAY DEVICE THEREON

This application is a continuation of application Ser. No. 09/285,338 filed Apr. 2, 1999.

This application claims the benefit of Korean Patent Application Nos. 98-44475, filed on Oct. 23, 1998 and 98-44973, filed on Oct. 27, 1998, which are hereby incorporated by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to a flat panel display device, and more specifically, to a flat panel display device mounting structure and a method of mounting the flat panel display device to a computer.

2. Description of the Related Art

Flat panel display devices include liquid crystal display devices (LCD) which are being used widely, plasma display panels (PDP), and field emission displays (FED) which have been studied recently and may be applied to computers in the near future. For convenience of explanation, the present invention will be discussed with respect to the LCD as an example of the flat screen type display devices and a portable computer mounted with the LCD.

Referring to FIG. 1, a general portable computer such as a laptop or notebook computer typically includes a body 100, a flat panel display device assembly 110 coupled to the body 100 via a hinge mechanism 124. The flat panel type display device assembly 110 has a flat panel display device 111 and a display case 122 supporting the flat panel display device 111. The body 100 has an input device 102 such as a keyboard. As a flat panel type display device 111, the LCD is widely used in portable computers and flat screen monitors.

Referring to FIG. 2 which shows conventional assembly structure of the LCD device applied to a conventional portable computer, the display case 122 has a rear case 123 and a front case or frame 121 for mounting the LCD device 130. The rear case or frame 123 has an outer surface and an inner surface and connecting ribs 123a are formed at the corners.

The LCD device 130 has an LCD panel 132, a backlight device 134 fixed to the back of the LCD panel 132, and a supporting frame 136 for assembling the LCD panel 132 and the backlight device 134 along the edge.

At the corners of the supporting frame 136, corresponding to the positions of the ribs 123a of the rear case 123, a plurality of protrusions 136a having holes are formed.

For mounting the LCD device 130 to the display case 122, the LCD device 130 is placed on the rear case 123 and the holes of the supporting frame 136 and the ribs 123a are fastened together preferably by screws 138. The front case 121 is coupled to the rear case 123.

Hereinafter, the way in which the LCD device is mounted to the case from the front toward the rear direction is defined as the front mounting method, and the assembled structure of the LCD device and the case formed through the front mounting method is defined as the front mounting structure.

In the front mounting structure of the LCD device, since the protrusions 136a require additional space corresponding to the protruded width d, the display area of the LCD device is reduced in comparison to the fixed size of the display case 122.

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The front mounting structure may also include an additional feature to further support the LCD device as shown in FIGS. 3A and 3B.

Referring to FIGS. 3A and 3B, a conventional LCD device assembly 110 includes an LCD panel 112 and a backlight device (not shown) for the LCD panel 112 and display case 122 supporting the LCD device 111. The LCD panel 112 and the backlight device are assembled by a supporting frame 114 along the edges.

The display case 122 is coupled to a body 120 via a hinge mechanism 124, which may extend from the body 120. The display case 122 and the hinge mechanism 124 are assembled through a hinge arm 126, allowing the flat panel display device assembly 110 to pivotally move with respect to the body 120.

Two opposite sides of the supporting frame 114 include flanges 114a for assembling the LCD device 111 to the display case 122, and corners include flanges 114b for assembling the LCD device 111 to the hinge arm 126. Hereinafter, the former is referred as a fixing flange and the latter is referred as a mounting flange in this specification for distinction purposes. As shown in FIG. 3B, the fixing flanges 114a have a protruding width d2 and the mounting flanges 114b have a protruding width d1. A screw hole is formed in each of the flanges 114a and 114b. On the inner surface of the display case 122, ribs 122a are formed corresponding to the holes of the fixing flange 114a.

To mount the LCD device 111, the hinge arm 126 and the mounting flanges 114b are screwed together, and the fixing flanges 114a and the ribs 122a are screwed together by bolts 128.

In the mounting structure shown in FIG. 3B, the supporting frame 114 requires side spaces for the flanges 114a and 114b. Therefore, the side space D (d1+d2) results in a reduction of the display area of the LCD panel 112 relative to the display case 122. Moreover, as the display size increases, the display case becomes undesirably large, especially for a portable computer such as a laptop computer.

To solve the above problem and to provide a large display area with minimal display case size, a new mounting structure is needed for the LCD device.

SUMMARY OF THE INVENTION

Accordingly, the present invention is directed to a portable computer and method for mounting a flat panel display device thereon that substantially obviates one or more of the problems due to limitations and disadvantages of the related art.

An object of the present invention is to minimize the non-display area of the LCD device.

Another object of the present invention is to provide a computer having a flat panel display with a maximum display area and a minimal display case size.

Additional features and advantages of the invention will be set forth in the description which follows, and in part will be apparent from the description, or may be learned by practice of the invention. The objectives and other advantages of the invention will be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described, a portable computer includes a body having an information input device; a case coupled to the body and having inner and outer surfaces; and a flat panel

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display device having a display surface and a rear surface, the rear surface being fixed to the inner surface of the case.

According to another aspect of the present invention, a portable computer includes a body having an information input device; a flat panel display case coupled to the body; a flat panel display device having a display surface and a rear surface; and a hinge mechanism having a hinge mount and a hinge arm fixed to the rear surface of the display device

According to another aspect of the present invention, a method of mounting a flat panel display device to a hinge mechanism having a hinge mount, a hinge arm, and a pin portion rotating in the hinge mount, the flat panel display device having a display surface and a rear surface, the method including a step of fixing the rear surface of the flat panel display device to the hinge arm. The fixing step is preferably carried out by attaching the hinge arm and the rear surface of the flat display device using a screw.

According to a further aspect of the present invention, an LCD device coupled to an outer case includes an LCD panel having a display surface and a rear surface; a backlight device having a first surface facing the rear surface of the LCD panel and a second surface attached to the outer case; and a supporting frame for assembling the LCD panel and the backlight device.

It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

In the drawings:

FIG. 1 is a perspective view showing a general portable computer;

FIG. 2 shows a conventional mounting structure of the LCD device for a portable computer;

FIGS. 3A and 3B are a perspective view and a front view, respectively, showing a mounting structure of the LCD device for a portable computer;

FIGS. 4A-4C show the LCD device according to a first embodiment of the present invention;

FIG. 5 shows a mounting structure in accordance with a first embodiment in accordance with the present invention;

FIG. 6 shows a mounting structure in accordance with a second embodiment in accordance with the present invention;

FIG. 7 is a partial sectional view showing the assembled state of the structure in FIG. 6;

FIG. 8 is a perspective view showing a back mounting structure of the LCD device according to a third embodiment in accordance with the present invention;

FIG. 9 is a perspective view showing a back mounting structure of the LCD device according to a fourth embodiment in accordance with the present invention;

FIG. 10 is a front view showing the structure of FIG. 9;

FIG. 11 is a fifth embodiment in accordance with the present invention which is an alternate embodiment to FIG. 10 where the hinge mount is fixed to the display case;

FIGS. 12, 13, and 14 are sixth, seventh, and eighth embodiments in accordance with the present invention;

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FIG. 15 is a side view showing a back mounting structure of the LCD device according to a ninth embodiment of the present invention; and

FIG. 16 is a partial sectional view showing the assembled state of the structure in FIG. 15.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Reference will now be made in detail to the preferred embodiments of the present invention, an example of which is illustrated in the accompanying drawings.

The present invention provides a back mounting method and a back mounting structure for a display panel device in a portable computer. Moreover, the rear surface of the display panel device may be coupled to a hinge arm for further support of the display panel device.

FIGS. 4A-4C show a first embodiment of the present invention. Referring to FIGS. 4A and 4B, the LCD device 10 has an LCD panel 12, a backlight unit 14, and a supporting frame 16. FIG. 4C shows an example of a detailed structure of the LCD device 10 shown in FIGS. 4A and 4B. Referring to FIG. 4C, the LCD device 10 has a first frame 14g, preferably made of plastic, a reflector 14f on the frame 14g, a light guide film 14e, a diffuser or protecting film 14d, a first prism sheet 14c, a second prism sheet 14b, another diffuser or protecting film 14a, and the LCD panel 12. The first frame 14g is coupled to a second frame or supporting frame 16. At each corner of the first frame 14g a screw hole 15 is preferably formed. Although FIG. 4C shows the first frame 14g as part of the backlight unit 14, the first frame 14g can act as the supporting frame 16.

To mount the LCD device 10 to the display case 30 (FIG. 8), the LCD device 10 is placed on the inner surface of the display case 30. Then, the case 30 and the LCD device 10 are attached to one another by bolts 18 (which may be referred to as fastening elements, fastening parts, or a similar conveniently descriptive term) into the screw-hole 15 (which may be referred to as a fastening hole or a similar conveniently descriptive term, and which together with the material defining the hole may be referred to as a fastening element or fastening part) from the back of the display case 30.

As explained above, the structure shown in FIGS. 4A-4C has an advantage in that the side space such as width d2 for fixing flange 114a of FIG. 3B is not needed and the size ratio between the display area and the display case is improved.

FIG. 5 shows the assembly of the LCD device 10 to the display case 21 of a portable computer according to a first embodiment of the present invention. The computer includes a body 20 or first section having an information input device and a second section including the case 21. The case 21 may cover the body 20 and is coupled to the body through a hinge mechanism. Together, the case 21 and the body 20 may be referred to as a housing, or a similar conveniently descriptive term. Preferably at each corner of the case 21 a through-hole 21a (which may be referred to as a fastening hole or a similar conveniently descriptive term, and which together with the material defining the hole may be referred to as a fastening element or fastening part) is formed.

To mount the LCD device 10 to the case 21, the LCD device 10 is placed on the inner surface of the case 21 such that the positions of the holes 21a and the holes 15 coincide with each other, and screws 18 (fastening elements or fastening parts) are inserted into the holes 21a and 15 (which may be referred to as fastening holes or a similar conve-

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niently descriptive term, and which together with the material defining the holes each may be referred to as a fastening element or fastening part) from the back of the case 21. The through-hole 21a is preferably a stepped hole so that the head of the screw 18 will not protrude from the outer surface of the case 21.

Although not shown in FIG. 5, a front case such as shown in FIG. 2 is preferably assembled with the display case 21 for covering the edges of the LCD device 10.

FIG. 6 shows a back mounting structure of the LCD device according to a second embodiment of the present invention, and FIG. 7 is a detailed partial sectional view showing the assembled state of the LCD device 10 and the case 21 in accordance with the second embodiment.

At the rear surface of the backlight device 14 of the LCD device 10, fasteners 17 (fastening elements or fastening parts) such as hooks made of plastic are formed, and the case 21 has corresponding ribs 23 (also fastening elements or fastening parts). Preferably, the ribs 23 do not protrude over the width of the supporting frame 16. A rib 23 has a stepped hole 21b. The fastener 17 is supported and latched by the stepped portion of the hole 21b. To facilitate the disassembly or release of the fastener 17 from the hole 21b, the hole is preferably a through-hole extending all the way to the outer surface of the case 21. The hole 21b may be covered by a cover 21c.

The fastener 17 has a compressible head which compresses into a small diameter to allow the fastener to enter and slide through the hole 21b. Once the head reaches the stepped portion, the head returns to its original diameter and snaps or latches onto the stepped portion of the rib 23. In order to disassemble or release the LCD device 10 from the case 21, a pair of tweezers or similar tool can be adapted for compressing the head of the fastener 17 from the back of the case 21 through the hole 21b. The fastener 17 is unlatched and can freely slide out of the hole, 21b. As an alternative embodiment, the fastener 17 can be formed on the case 21 and the stepped hole can be formed at the rear face of the LCD device 10 to achieve similar results.

FIG. 8 is a perspective view showing a mounting structure of the LCD device according to a third embodiment of the present invention. There may be one or more hinge mechanisms for the LCD device; however, for convenience of explanation, only one hinge mechanism will be explained.

Referring to FIG. 8, a body 20 includes a hinge mount 22, where a hinge arm 24 is connected. The hinge arm 24 has a pin portion 24a and a flat or extended portion 24b. The former is for being mounted to the hinge mount 22, and the latter is for being coupled to the rear surface of the LCD device 10. The various hinge components may be separate pieces of attached members or a single structure.

The flat portion 24b can be elongated in various directions and by various methods. FIG. 8 shows one example of the flat portion 24b which is in the shape of an inverted "F" having a first support member extending in one direction and a second support member extending in a second direction substantially perpendicular to the first direction. At each end of the flat portion 24b, a hole such as a through-hole 24c (which may be referred to as a fastening hole or a similar conveniently descriptive term, and which together with the material defining the hole may be referred to as a fastening element or fastening part) is preferably formed. At the back surface of the LCD device 10, pegs 15a having mounting holes formed therein are formed corresponding to the positions of the through-holes 24c. The pegs 15a together with the mounting holes formed therein may be referred to as a

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fastening element or fastening part and as shown in FIG. 8 protrude away from the LCD device 10. The through-holes 24c are preferably screw holes. In the display case 30, a hole such as a through-hole 30 (which may be referred to as a fastening hole or a similar conveniently descriptive term, and which together with the material defining the hole may be referred to as a fastening element or fastening part) may be formed. Moreover, although hole 30a may be formed at the corresponding position of the through-hole 24c of the flat portion 24b, alternatively, the flat portion may be in an inverted "L" shape.

To mount the LCD device 10, the body 20 (first portion) and the display case 30 (second portion) (collectively referred to as a housing) are connected by the pin portion 24a on the hinge mount 22. The display case 30, the hinge arm 24 (referred to as a display device support member), and the LCD device 10 are preferably attached together by screws 18 (fastening elements or fastening parts) through the mounting hole of the pegs 15a and the screw hole 24c. Alternatively, nails or other similar known fastening elements or fastening parts can be adopted for this purpose.

Referring to FIGS. 9 and 10 which show a fourth embodiment of the hinge arm 24, the flat portion 24b of the hinge arm 24 is extended upwards and preferably extended to almost the entire height of the LCD device 10. In the flat portion 24b according to this embodiment, it is preferable to form a mounting hole 24c and the through-hole 30a at the same position. It is also possible to form the holes 24c and 30a at different positions relative to the display case. Thus, additional mounting hole 15a may not be necessary for this embodiment. The mounting structure of this embodiment may be stronger than that of the second embodiment. The LCD device 10, the elongated hinge arm 24, and the display case 30 are fastened together by screws 18, for example.

FIG. 11 shows a fifth embodiment of the present invention, where the hinge mount 22 is preferably fixed to the display case 30, but a fixed flange 26 is secured to the body 20. The structure of the hinge arm 24 and other elements are similar to those shown in FIGS. 9 and 10.

FIGS. 12-14 show three alternative embodiments of the embodiments shown in FIGS. 9 and 11. In FIG. 12, the sixth embodiment of the present invention, the hinge arm 24 has a shape of the letter "E." In FIG. 13, the seventh embodiment of the present invention, the hinge arm 24 has the shape of the letter "C." In FIG. 14, the eighth embodiment of the present invention, the hinge arm 24 has the shape of the letter "H." The fastening holes may be formed at various positions on the hinge arm 24 as desired to secure the hinge arm to the display case 30. Combinations and other variations of these different embodiments are contemplated in the present invention with the purpose of supporting the LCD panel, preferably through the back of the LCD panel and the case. For example, the seventh and eighth embodiments may be combined to provide a stronger support of the LCD panel. Moreover, the hinge mount may be fixed to the body 20 (FIG. 10) or the display case 30 (FIG. 11) in these embodiments.

The present invention contemplates the use of fastening devices other than screws. One such alternative embodiment is shown in FIGS. 15 and 16.

FIGS. 15 and 16 show the mounting structure according to a ninth embodiment of the present invention. At the rear surface of the LCD device 10, at least one fastener (fastening element or fastening part) such as a hook 19, preferably made of plastic or other suitable material, is formed. As can be seen from FIGS. 15 and 16, the hook 19 protrudes away

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from the LCD device 10 and includes a first part and a second part where the first part is larger than the second part. In the flat portion 24b of the hinge arm 24 (referred to as a display device support member), at least one corresponding through-hole (which may be referred to as a fastening hole or a similar conveniently descriptive term, and which together with the material defining the hole may be referred to as a fastening element or fastening part) is formed. In the display case, at least one stepped hole 30b (which may be referred to as a fastening hole or a similar conveniently descriptive term, and which together with the material defining the hole may be referred to as a fastening element or fastening part) corresponding to the through-hole in the hinge arm 24 is formed to support and/or latch the fastener 19. To facilitate the disassembly or release of the fastener 19 from the hole 30b through the rear of the case 30, the hole 30b is preferably a through-hole.

To assemble the LCD device to the hinge arm 24 and display case 30, the hinge arm 24 is mounted to the hinge mount 22 (as shown in FIGS. 10 and 11) and the through-hole 24c (see FIGS. 12-14) of the hinge arm 24 and the hole 30b (see FIGS. 15-16) are coincidentally placed. Then, the LCD device 10 with at least one fastener 19 is pressed into the hole 30b and latched onto the display case 30, as shown in detail in FIG. 16. Here, the fastener 19 will slide through the hole 30b and snap into place by the protruding or wing portions of the head of the fastener 19. To disassemble the LCD device 10 from the display case 30, a device such as tweezers or other suitable tool can be adapted for squeezing the head or top portion of the fastener 19 from the back of the case 30 through the hole 30b. The fastener 19 is unlatched and can freely slide out of the hole 30b. The hole 30b can be covered by a cover 30c.

Alternatively, the fastener 19 can be formed on the case 30 and the stepped hole can be formed at the rear face of the LCD device 10 to achieve similar results.

As explained above, the mounting method according to the present invention does not require unnecessary side space for mounting the LCD device on the computer. Thus, the ratio of the display area of the LCD device to the display case can be improved and maximized.

In the above embodiments of the present invention, although the LCD device has been used as one type of flat panel display device, other flat panel display devices such as plasma display panels (PDP) and field emission displays (FED) may be used in accordance with the present invention. Moreover, in the above embodiments, other hinge mechanisms may be used such as a gear hinge as disclosed, for example, in U.S. application Ser. No. 08/937,801 filed on Sep. 25, 1997 entitled, "DISPLAY WITH GEAR TYPE HINGE," which is incorporated herein by reference.

It will be apparent to those skilled in the art that various modifications and variation can be made in the portable computer and method for mounting a flat panel display device thereon of the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention cover the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

What is claimed is:

1. A method of attaching a rear mountable display device to a housing for a portable computer, said housing comprising a first section having an information input device and a second section having a case including a first fastening element, the method comprising:

fastening the display panel to the case by the first fastening element and a second fastening element on a rear surface of the rear mountable display device;

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fastening a display device support member, having a third fastening element, to the case; and

fastening the rear mountable display device to the display device support member by the third fastening element.

2. The method of claim 1, wherein at least one of the first and second fastening elements includes a fastening hole.

3. The method of claim 1, wherein the second fastening element includes a fastening hole.

4. The method of claim 1, wherein the first and second fastening elements each include a screw hole.

5. The method of claim 4, wherein fastening the rear mountable display device to the case further comprises:

inserting a screw from a rear of the case through the screw holes of the first and second fastening elements; and

attaching the rear mountable display device to the case by the screw.

6. The method of claim 1, wherein fastening the rear mountable display device to the display panel support member comprises fastening the rear mountable display device to the display device support member by the first and third fastening elements.

7. The method of claim 6, wherein the third fastening element includes a fastening hole.

8. The method of claim 6, wherein the first and third fastening elements each include a screw hole.

9. The method of claim 8, wherein fastening the rear mountable display device to the display device support member further comprises:

inserting a screw through the screw holes of the first and third fastening elements; and

attaching the rear mountable display device to the case by the screw.

10. The method of claim 6, wherein the first, second and third fastening elements each include a screw hole.

11. The method of claim 10, wherein fastening the rear mountable display device to the display device support member further comprises:

inserting a screw from a rear of the case through the screw holes of the first, second and third fastening elements; and

attaching the rear mountable display device to the case by the screw.

12. The method of claim 1, wherein the first fastening element includes a stepped hole, the second fastening element includes a compressible head, and wherein fastening the rear mountable display device to the case comprises inserting the compressible head through the stepped hole.

13. The method of claim 1, wherein the first fastening element includes a fastening hole, the second fastening element comprises a hook, and wherein fastening the rear mountable display device to the case comprises pressing the hook through the fastening hole to snap the hook into place.

14. The method of claim 1, wherein the first fastening element includes a stepped hole, the second fastening element includes a compressible head, and the third fastening element includes a fastening hole, and wherein fastening the rear mountable display device to the case comprises inserting the compressible head through the fastening hole and the stepped hole.

15. The method of claim 1, wherein the first fastening element includes a first fastening hole, the second fastening element includes a hook, and the third fastening element includes a second fastening hole, and wherein fastening the rear mountable display device to the case comprises pressing the hook through the first and second fastening holes to snap the hook into place.

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16 The method of claim 1, wherein the display device support member extends substantially from a bottom portion of the second to a top portion of the second section.

17 A method of assembling a portable computer having a rear mountable display device and a housing comprising a first section having an information input device and a second section having a case including a first fastening element, the method comprising:

attaching the rear mountable display device to the case by the first fastening element and a second fastening element on a rear surface of the rear mountable display device;

coupling the first and second sections of the housing with a hinge; and attaching a display device support member to the rear mountable display device by a third fastening element on the display device support member

18 The method of claim 17, wherein at least one of the first and second fastening elements includes a fastening hole.

19. The method of claim 17, wherein the second fastening element includes a fastening hole.

20. The method of claim 17, wherein the first and second fastening elements each include a screw hole.

21. The method of claim 20, wherein attaching the rear mountable display device to the case further comprises:

inserting a screw from a rear of the case through the screw holes of the first and second fastening elements; and fastening the rear mountable display device to the case by the screw.

22. The method of claim 17, wherein attaching the rear mountable display device to the display device support member comprises fastening the rear mountable display device to the display device support member by the first and third fastening elements.

23. The method of claim 22, wherein the third fastening element includes a fastening hole.

24. The method of claim 22, wherein the first and third fastening elements each include a screw hole.

25. The method of claim 24, wherein attaching the rear mountable display device to the display device support member further comprises:

inserting a screw through the screw holes of the first and third fastening elements; and fastening the rear mountable display device to the case by the screw.

26. The method of claim 22, wherein the first, second and third fastening elements each include a screw hole.

27. The method of claim 26, wherein attaching the rear mountable display device to the display device support member further comprises:

inserting a screw from a rear of the case through the screw holes of the first, second and third fastening elements; and

fastening the rear mountable display device to the case by the screw.

28. The method of claim 17, wherein the first fastening element includes a stepped hole, the second fastening element includes a compressible head, and wherein attaching the rear mountable display device to the case comprises inserting the compressible head through the stepped hole.

29. The method of claim 17, wherein the first fastening element includes a fastening hole, the second fastening element comprises a hook, and wherein attaching the rear

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mountable display device to the case comprises pressing the hook through the fastening hole to snap the hook into place.

30. The method of claim 17, wherein the first fastening element includes a stepped hole, the second fastening element includes a compressible head, and the third fastening element includes a fastening hole, and wherein attaching the rear mountable display device to the case comprises inserting the compressible head through the fastening hole and the stepped hole.

31. The method of claim 17, wherein the first fastening element includes a first fastening hole, the second fastening element includes a hook, and the third fastening element includes a second fastening hole, and wherein attaching the rear mountable display device to the case comprises pressing the hook through the first and second fastening holes to snap the hook into place.

32. The method of claim 17, wherein the display device support member extends substantially from a bottom portion of the second section to a top portion of the second section.

33. A method of assembling a rear mountable flat panel display device capable of being mounted to a housing, comprising:

placing a flat display panel on a top surface of a backlight unit having a first frame, the first frame having a fastening element for fastening the first frame to the housing, said fastening element being located on a rear surface opposite the top surface of the backlight unit where the flat display panel is placed;

placing a second frame on the flat display panel; and fixing the flat display panel between the first frame of the backlight unit and the second frame.

34. The method of claim 33, wherein the fastening element comprises a fastening hole.

35. The method of claim 33, wherein the fastening element comprises a screw hole.

36. The method of claim 33, wherein the fastening element comprises a stepped hole.

37. The method of claim 33, wherein the fastening element comprises a compressible head.

38. The method of claim 33, wherein the fastening element comprises a hook.

39. A rear mountable method of assembling a liquid crystal display (LCD) device comprising:

arranging a first frame on a light guide, the first frame having holes for coupling a LCD panel to a supporting frame, the supporting frame having a front surface and a rear surface; and

coupling the LCD panel, the light guide to the first frame from the rear surface of the supporting frame.

40. A rear mountable method of assembling a liquid crystal display (LCD) device comprising:

arranging the LCD device on an inner surface of a display case, wherein the display case has an inner surface and back;

attaching the LCD device to the display case from the back of the display case

41. The rear mountable method of assembling a liquid crystal display (LCD) device of claim 40, wherein the LCD device is attached to the display case by bolts inserted into the holes from the back of the display case.

* * * * *

EXHIBIT 2



US006501641B1

(12) **United States Patent**
Kim et al.

(10) Patent No.: **US 6,501,641 B1**
(45) Date of Patent: **Dec. 31, 2002**

- (54) **PORTABLE COMPUTER HAVING A FLAT PANEL DISPLAY DEVICE**
- (75) Inventors: **Jong Hwan Kim; Young Woo Cho,**
both of Kyunggi-Do (KR)
- (73) Assignee: **LG. Philips LCD Co. Ltd., Seoul (KR)**
- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days

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Primary Examiner—Darren Schuberg

Assistant Examiner—Yean-Hsi Chang

(74) Attorney, Agent, or Firm—McKenna Long & Aldridge LLP

- (21) Appl No: 09/285,338
- (22) Filed: Apr. 2, 1999
- (30) Foreign Application Priority Data
- | | | |
|---------------|------|----------|
| Oct. 23, 1998 | (KR) | 98-44475 |
| Oct. 27, 1998 | (KR) | 98-44973 |
- (51) Int. Cl.⁷ H05K 7/16
- (52) U.S. Cl. 361/681; 361/681; 361/683;
361/729; 349/58
- (58) Field of Search 361/679-681,
361/683, 686; 349/58

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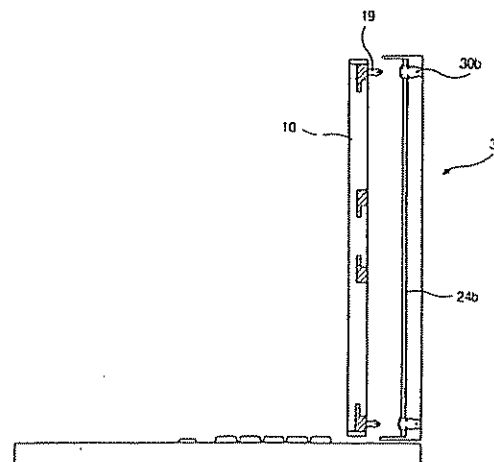
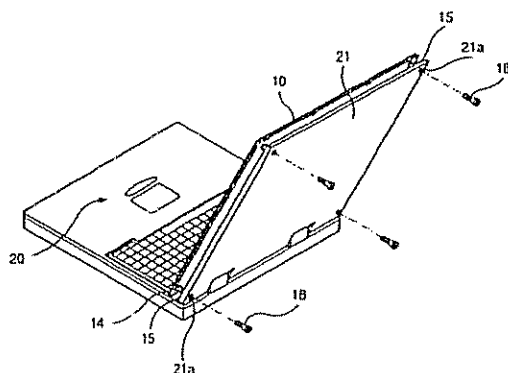
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(57) ABSTRACT

A portable computer including a housing having first and second sections, the first section having an information input device and the second section having a case having a first fastening element; a display panel including a second fastening element at a rear surface of the panel, the case and the display panel being attached through the first and second fastening elements; a hinge coupling the first and the second sections to each other; and a display panel support member having a third fastening element, the display panel support member being attached to the display panel through the third fastening

56 Claims, 16 Drawing Sheets

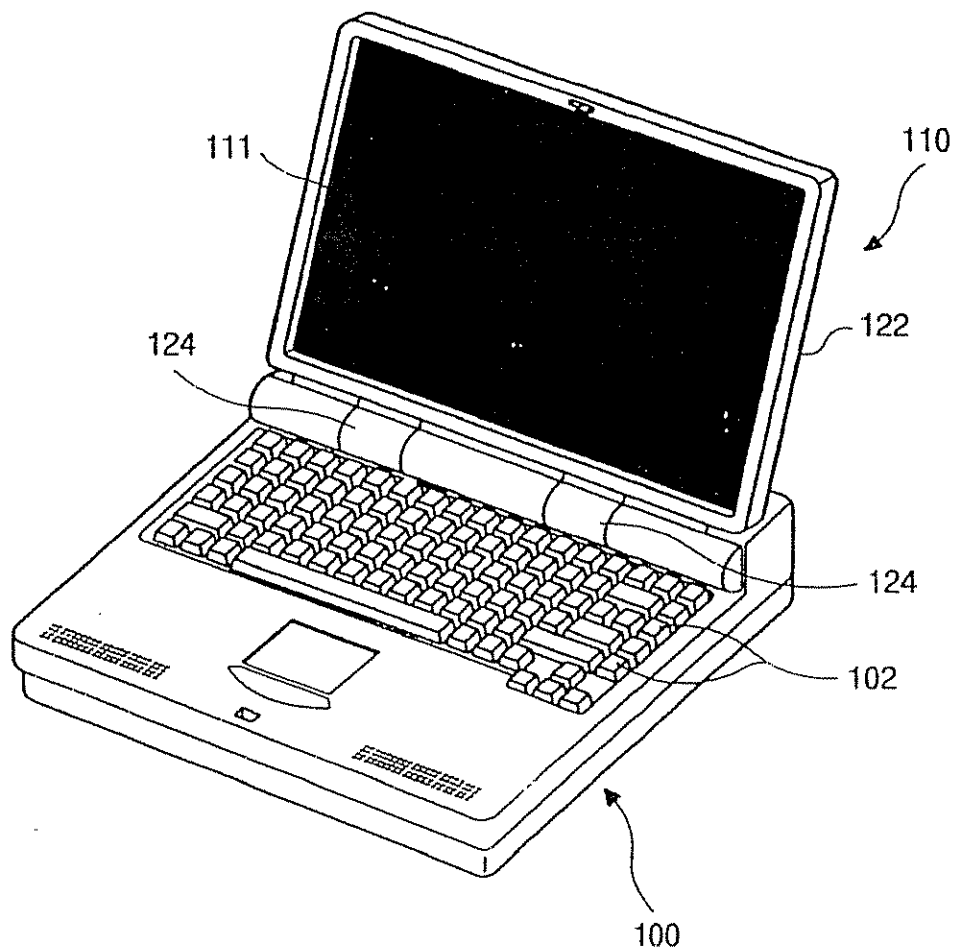


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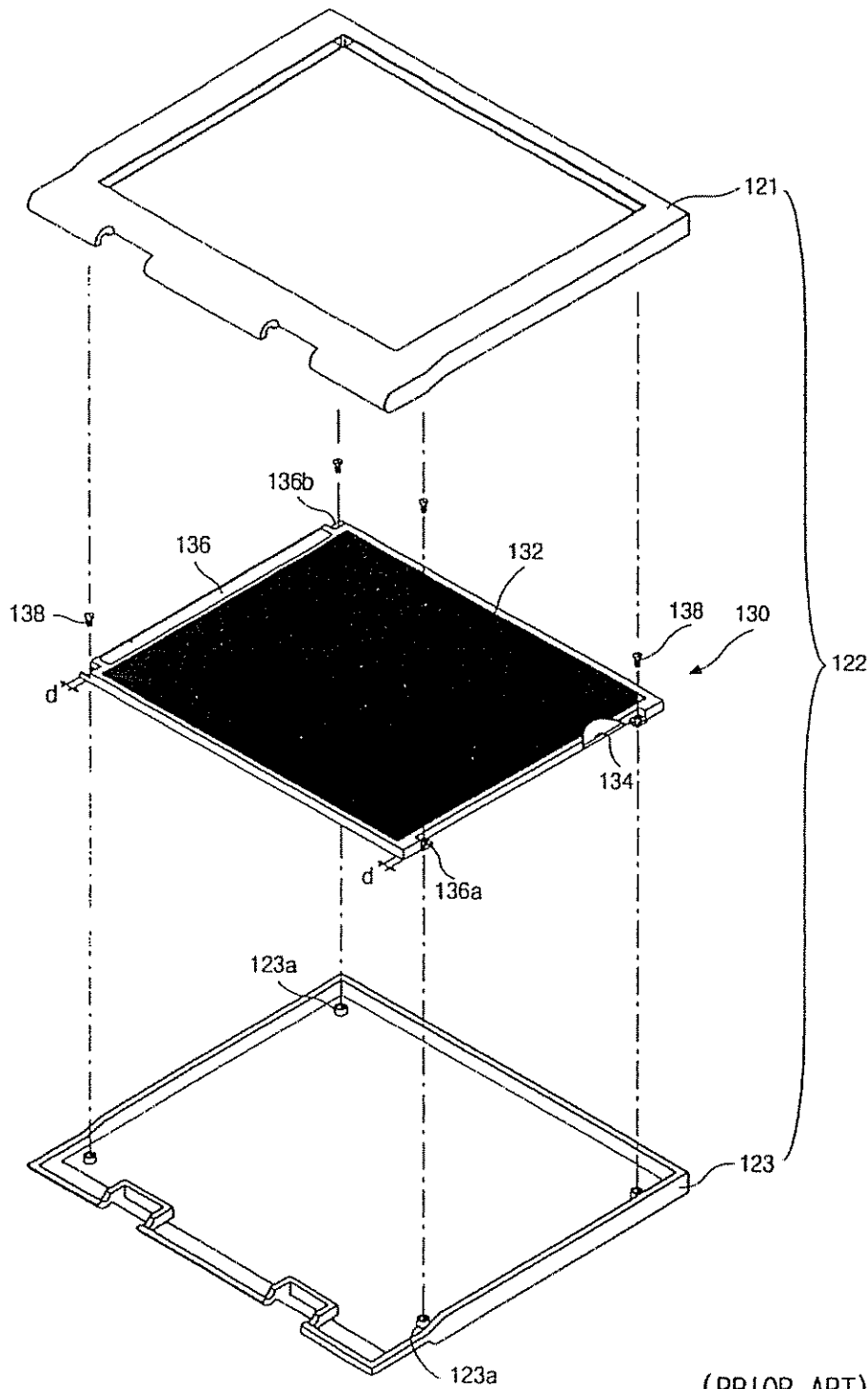
(PRIOR ART)
FIG. 1

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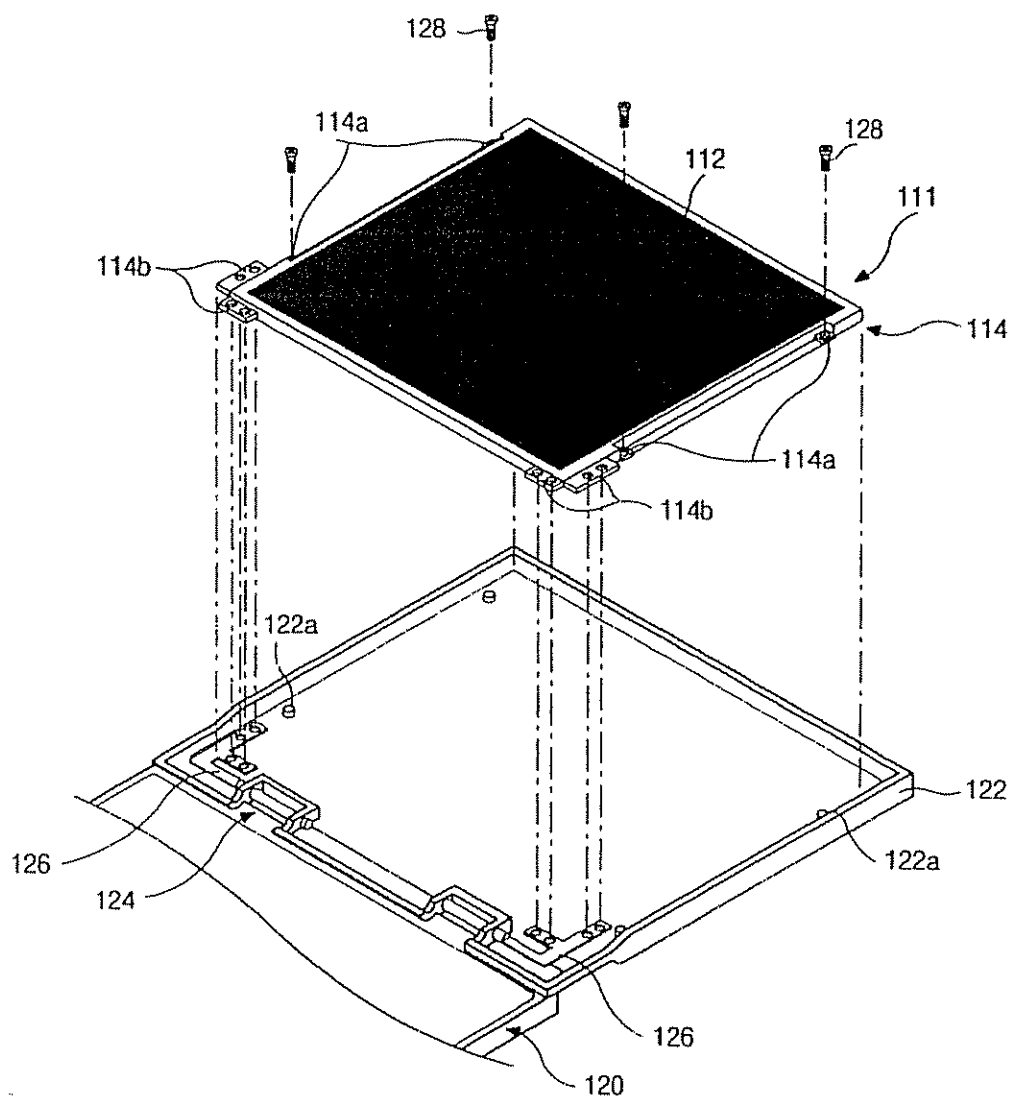
(PRIOR ART)
FIG. 2

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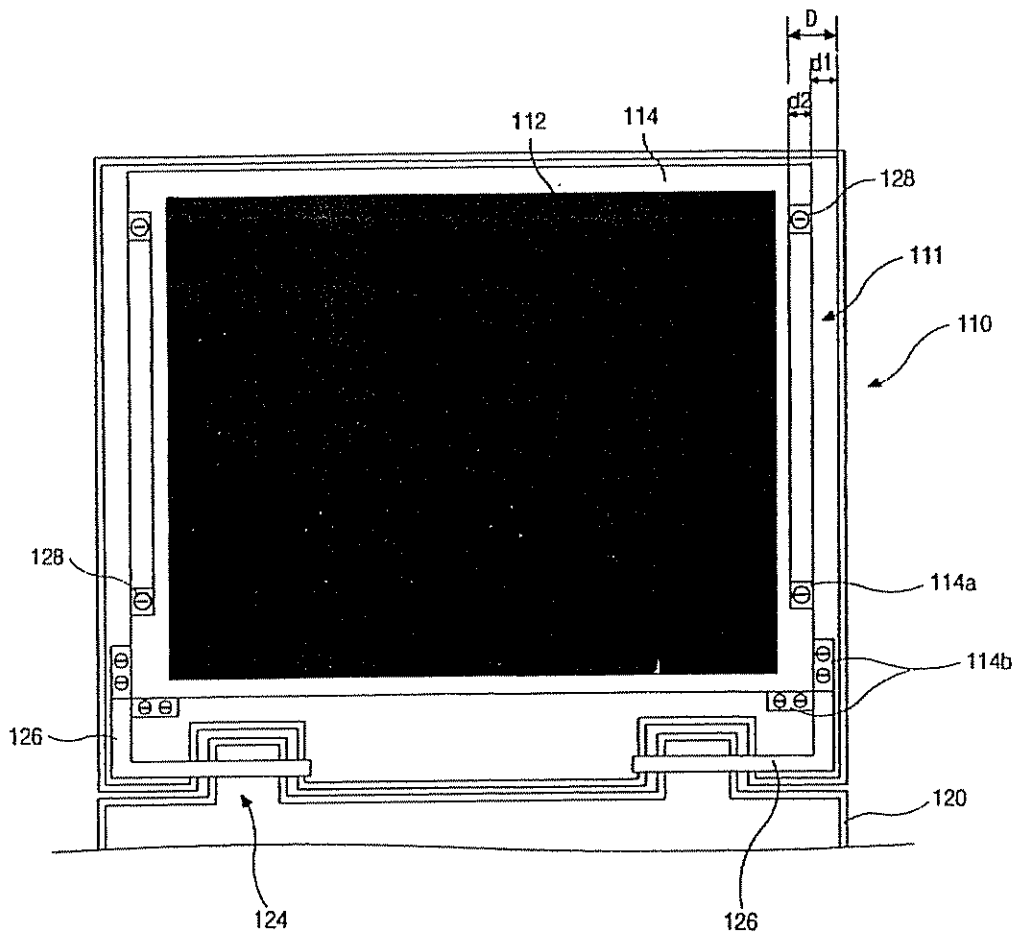
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(PRIOR ART)
FIG. 3A



(PRIOR ART)

FIG. 3B

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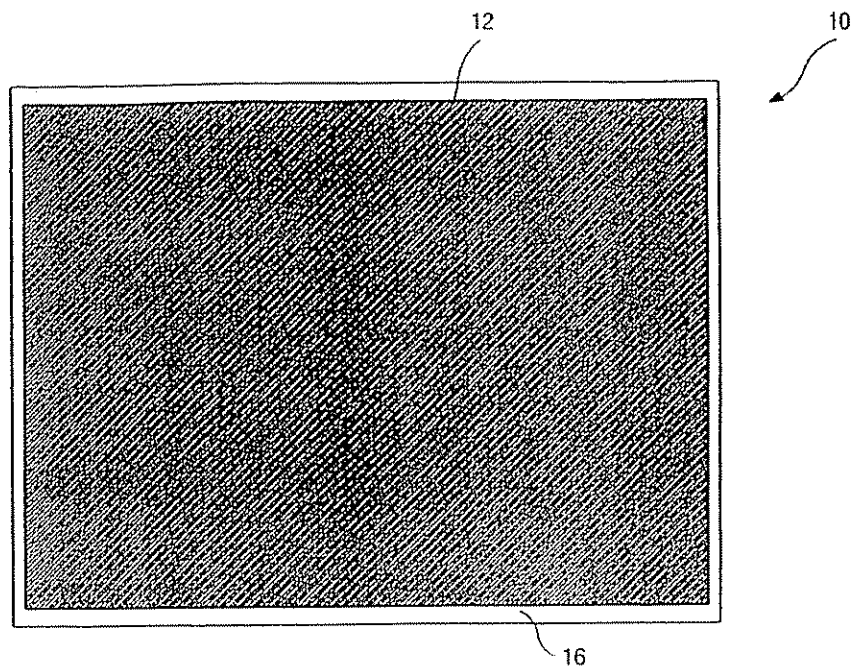


FIG. 4A

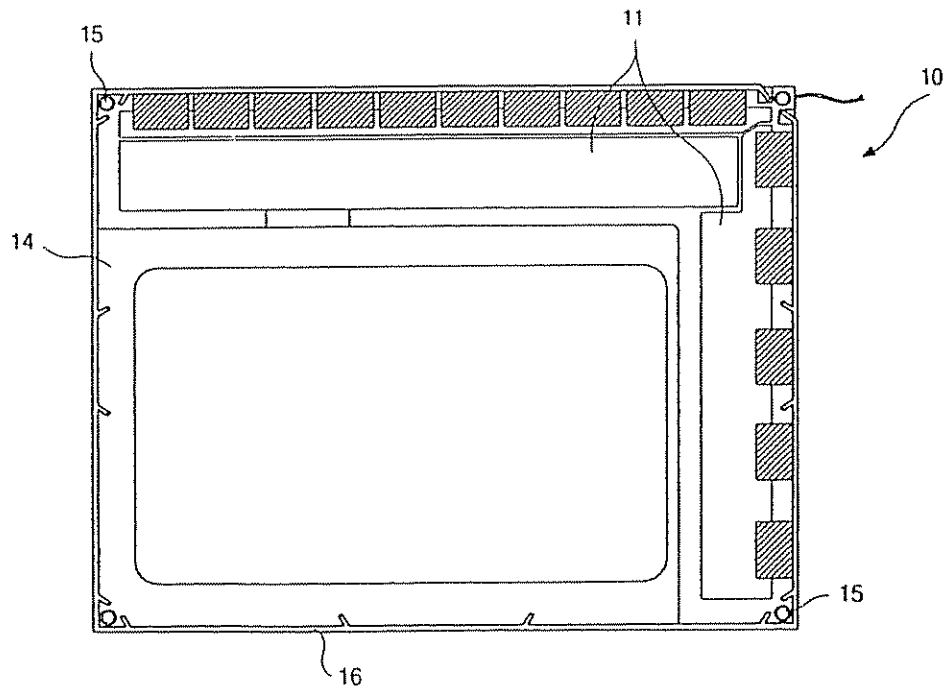


FIG. 4B

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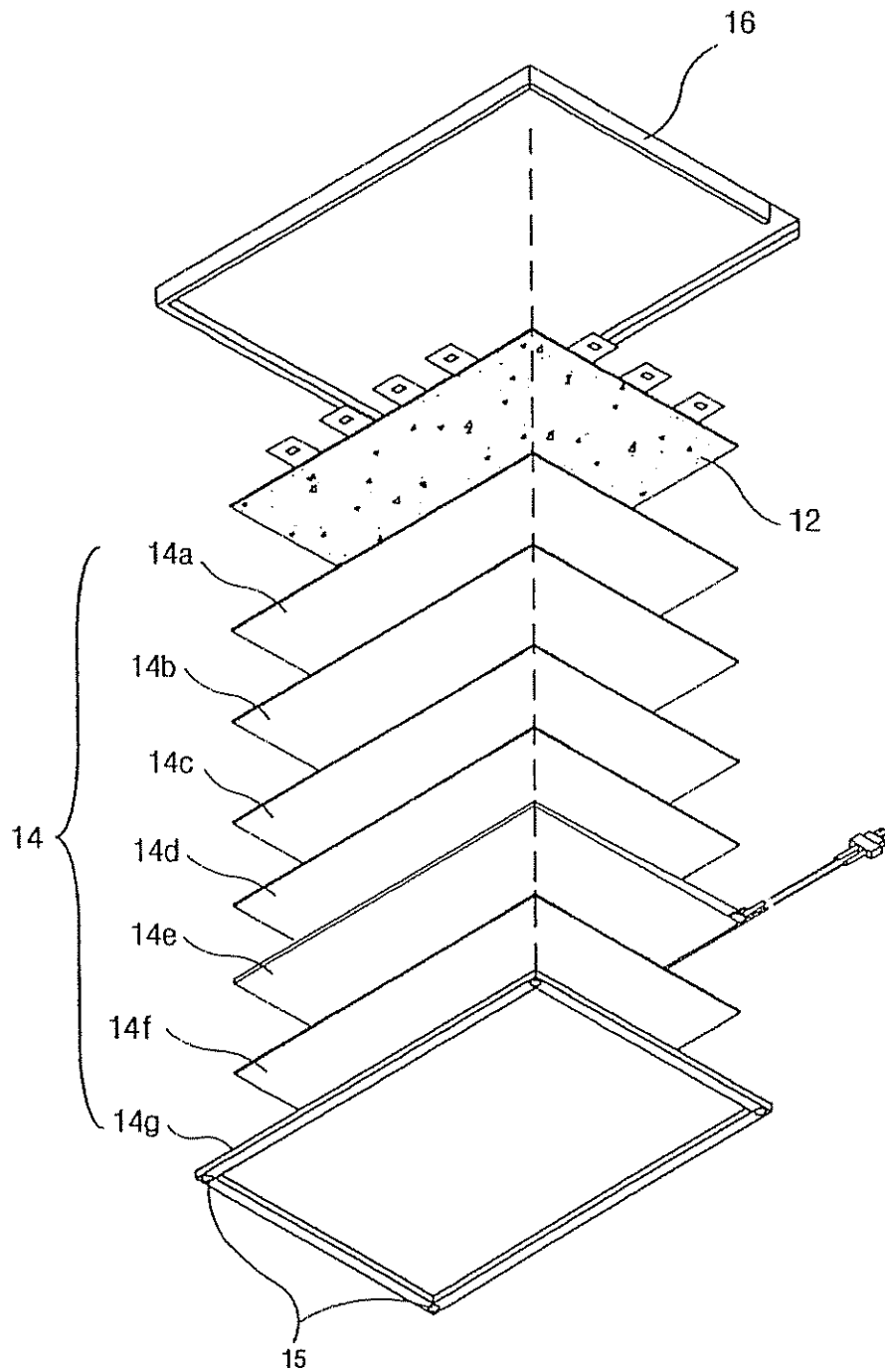


FIG. 4C

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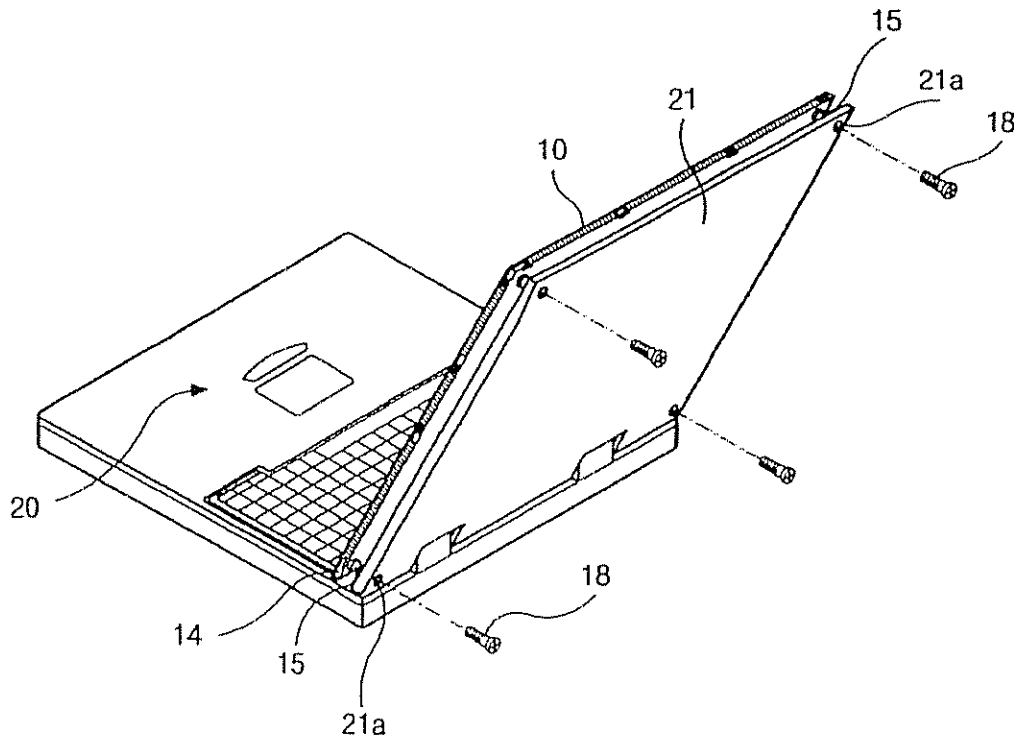


FIG. 5

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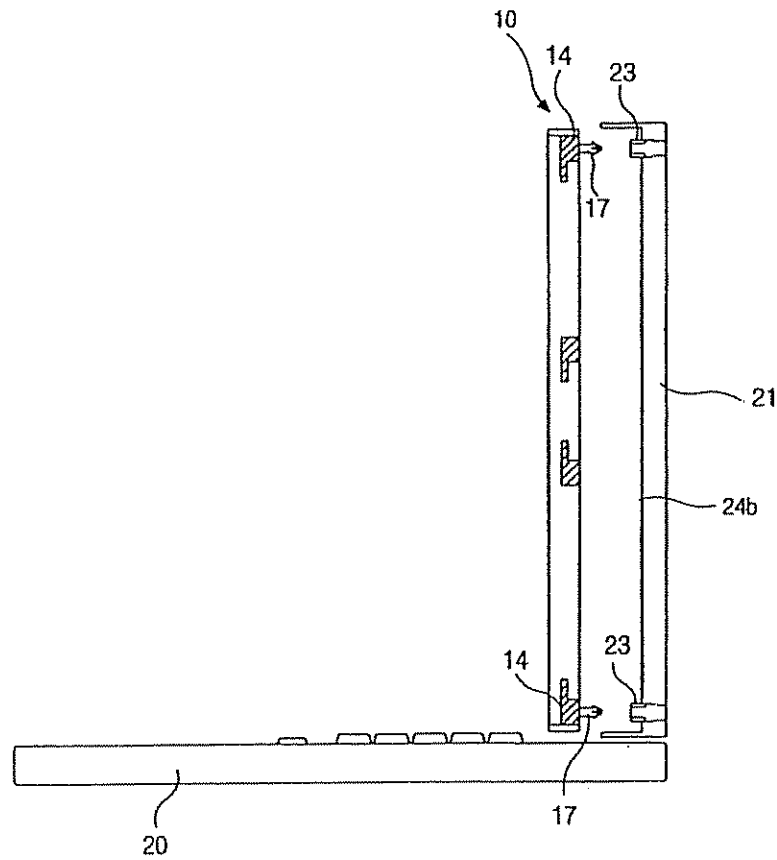


FIG. 6

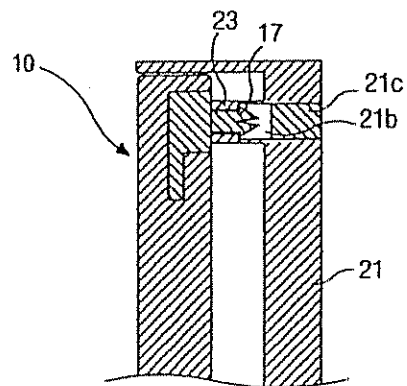


FIG. 7

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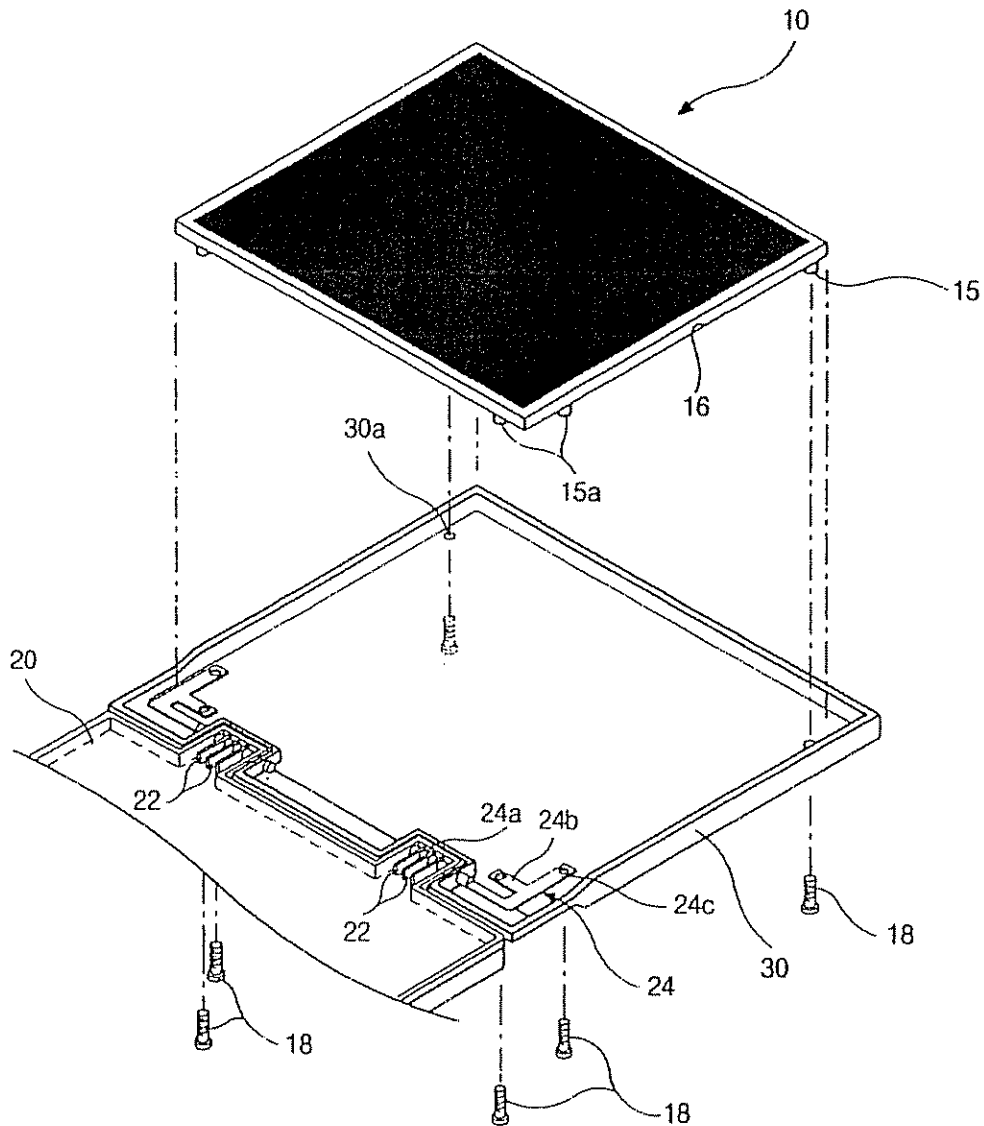


FIG. 8

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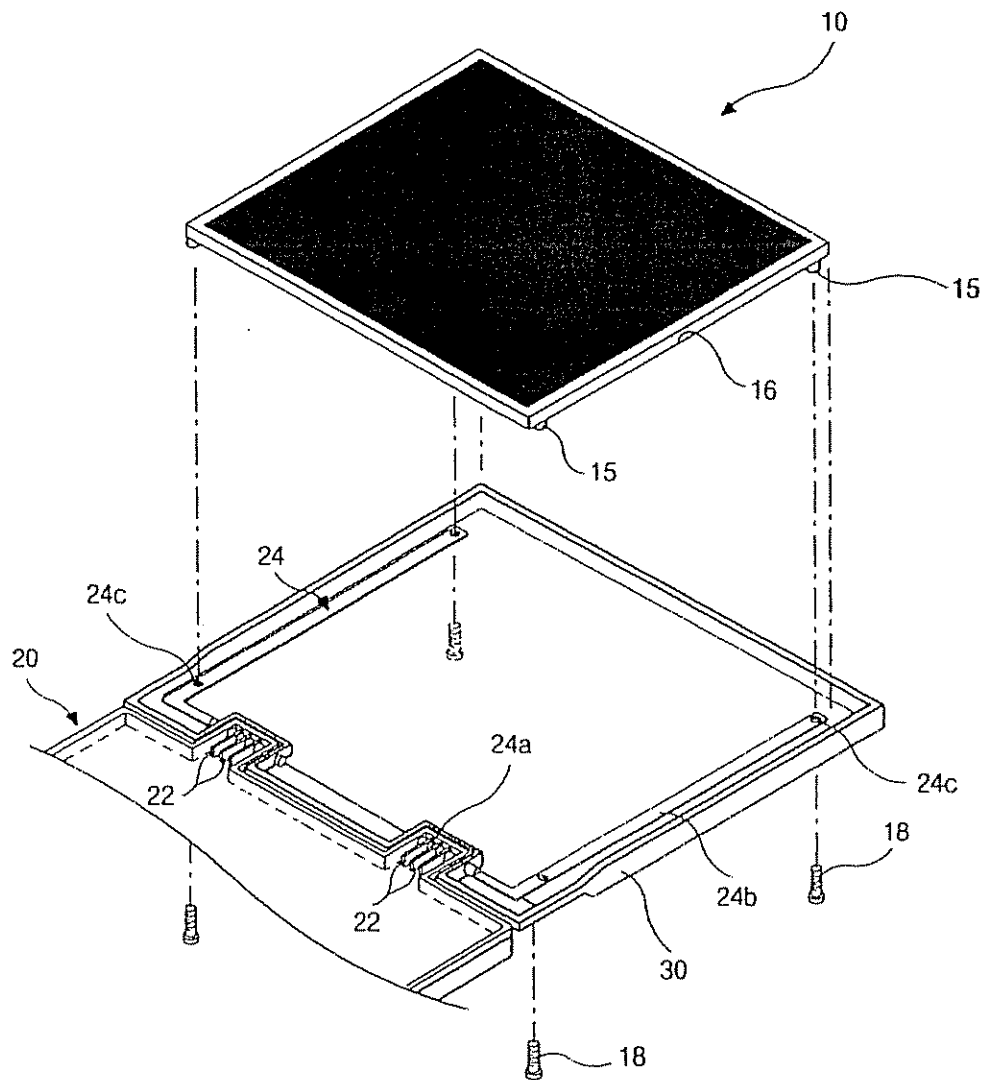


FIG. 9

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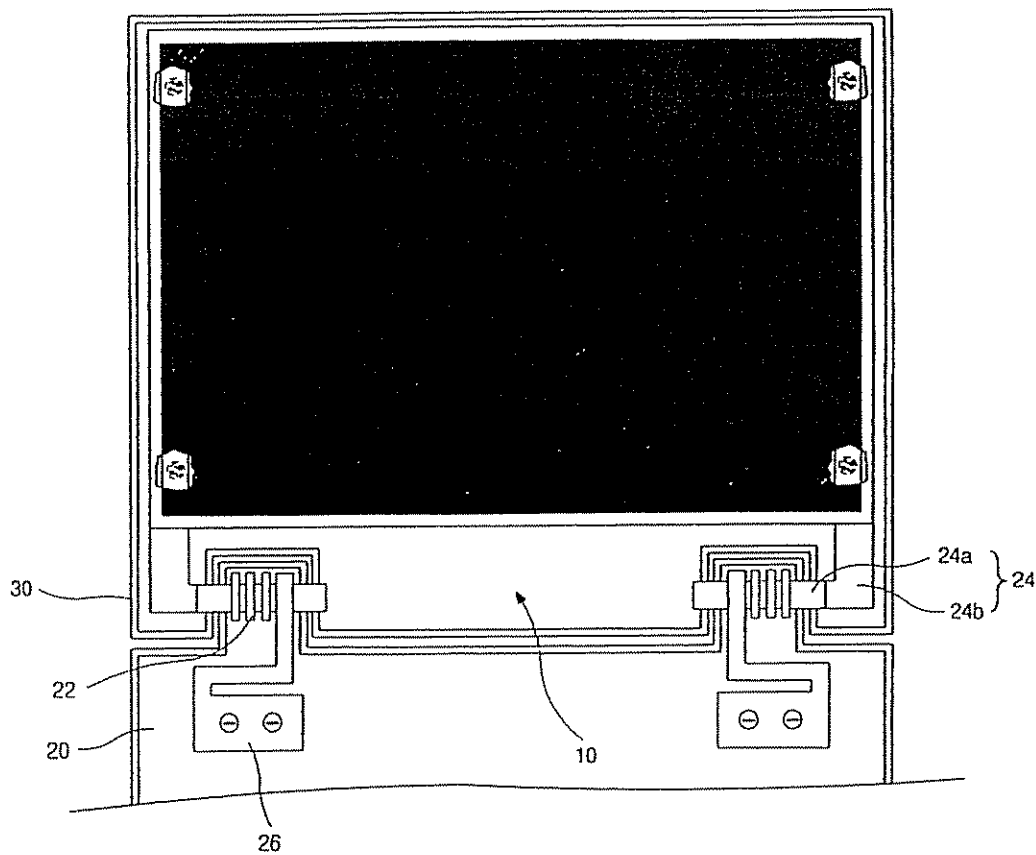


FIG. 10

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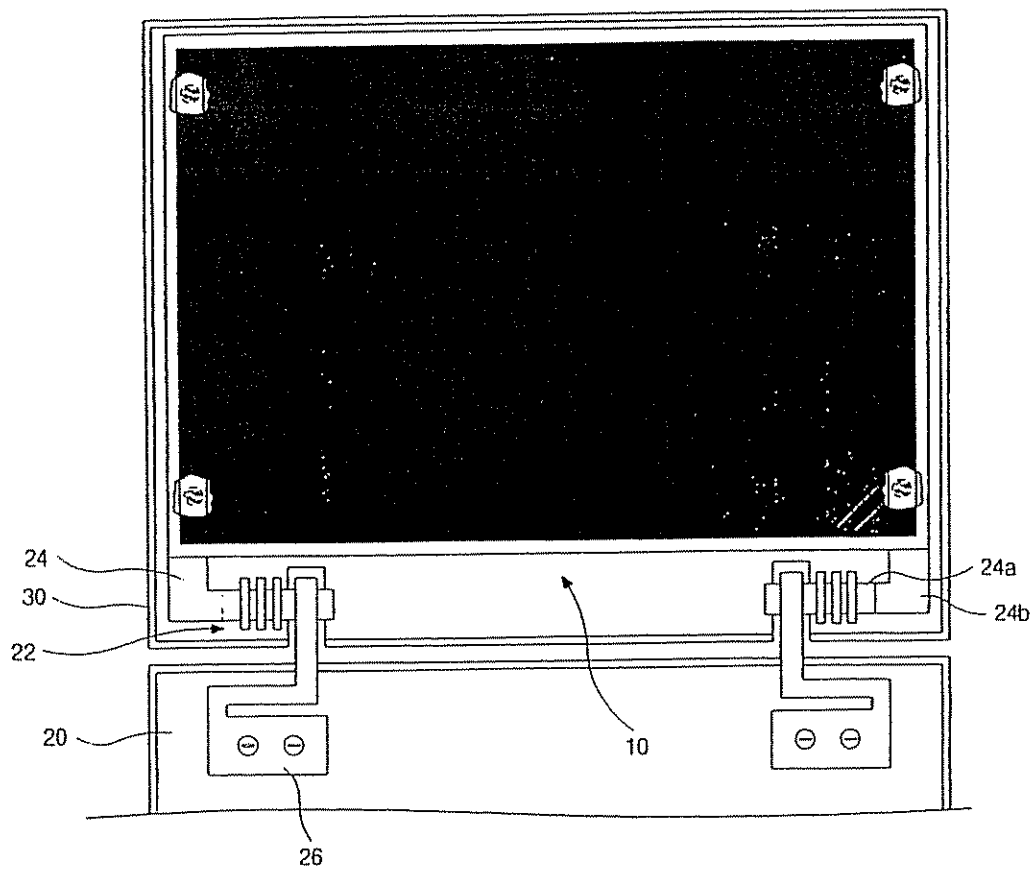


FIG. 11

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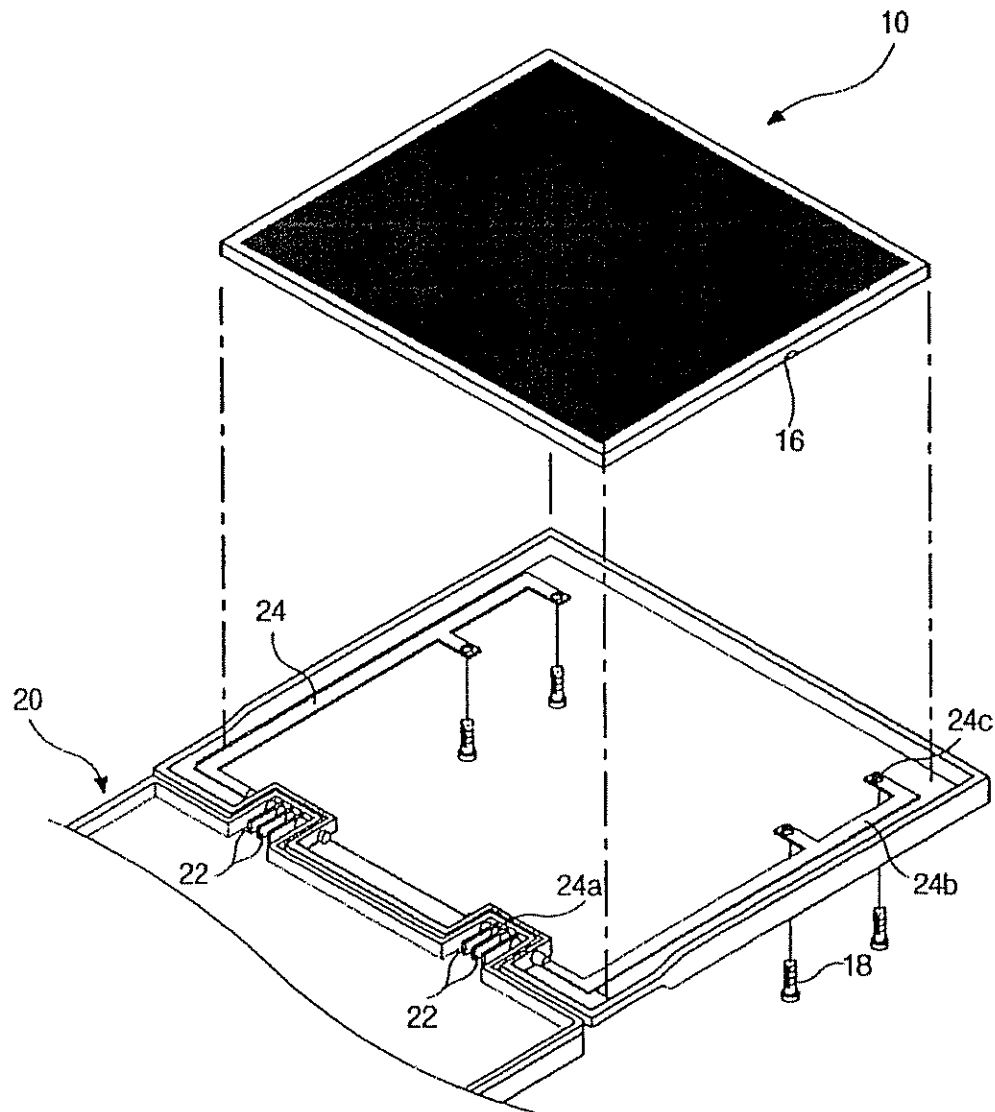


FIG. 12

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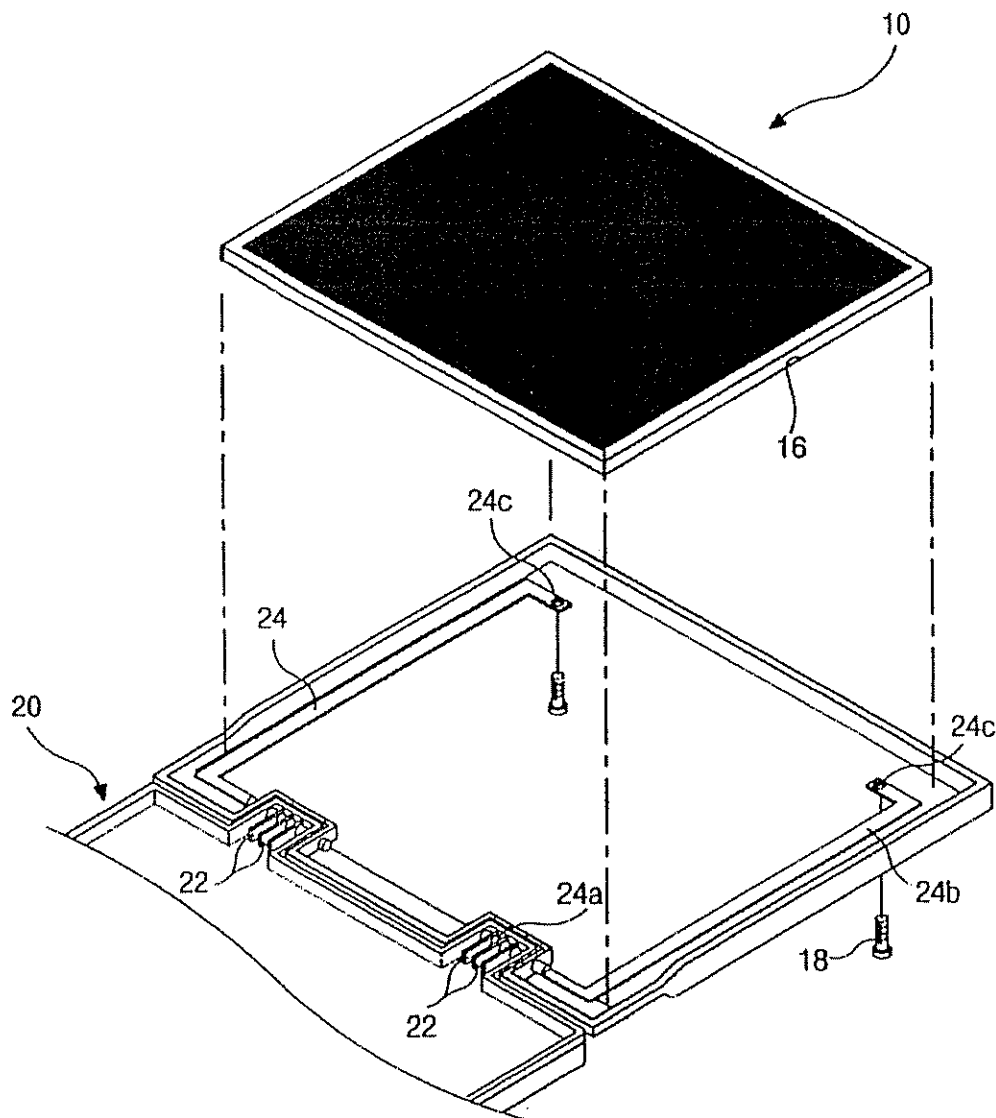


FIG. 13

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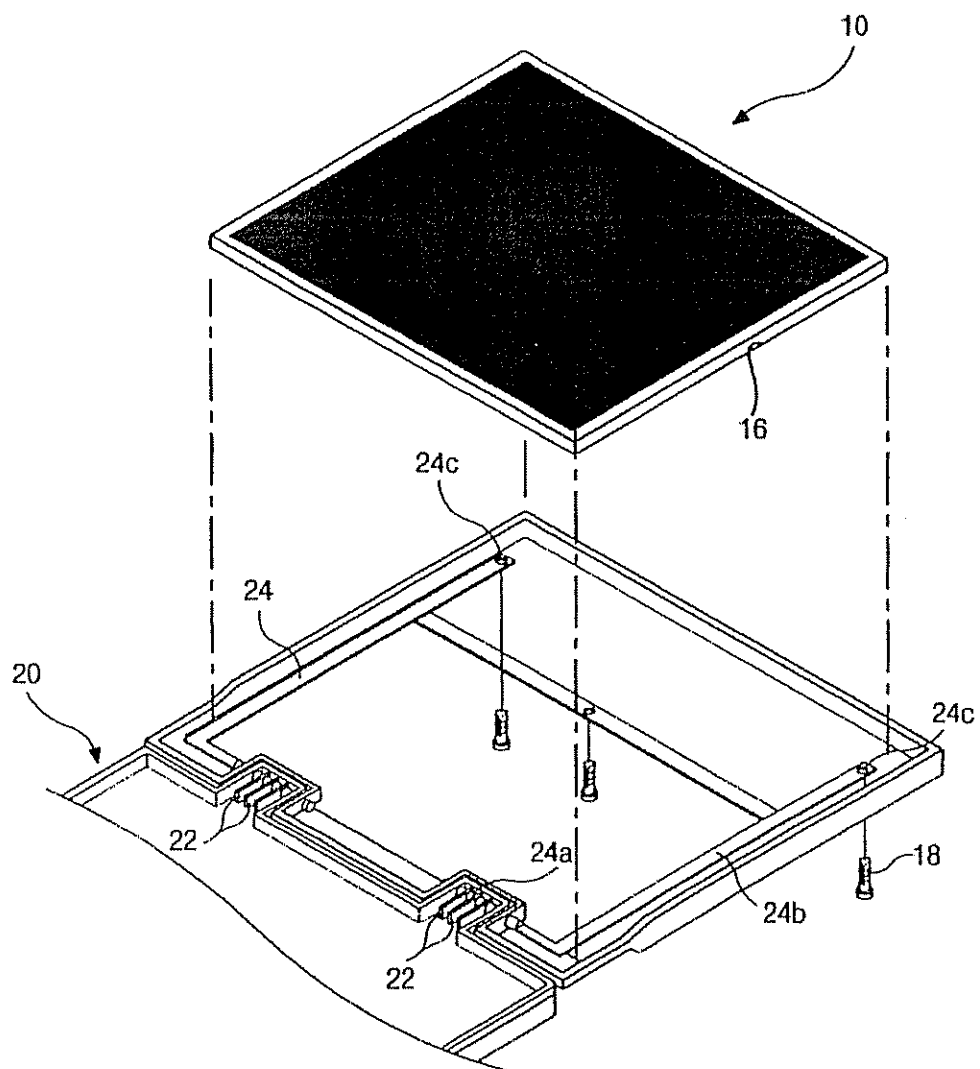


FIG. 14

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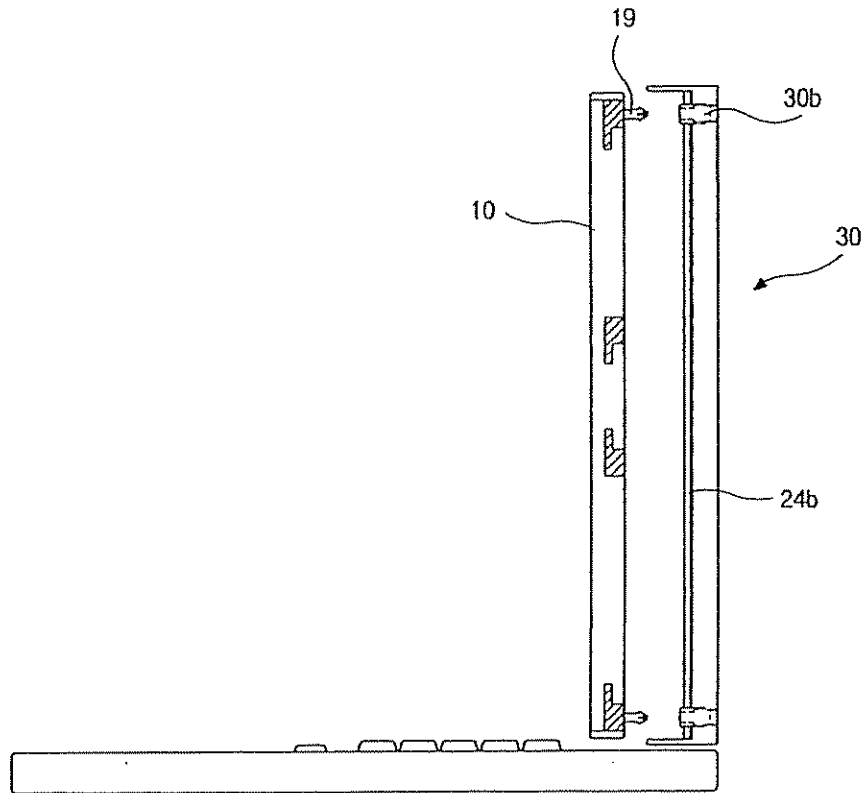


FIG. 15

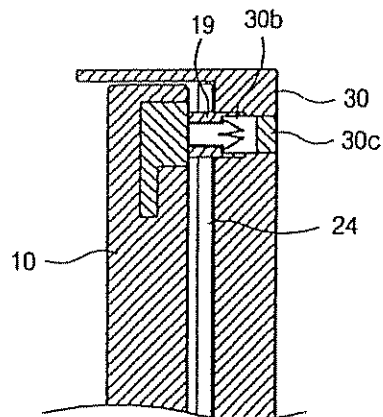


FIG. 16

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PORTABLE COMPUTER HAVING A FLAT PANEL DISPLAY DEVICE

This application claims the benefit of Korean Patent Application Nos. 98-44475, filed on Oct. 23, 1998 and 98-44973, filed on Oct. 27, 1998, which are hereby incorporated by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates generally to a flat panel display device, and more specifically, to a flat panel display device mounting structure and a method of mounting the flat panel display device to a computer.

2. Description of the Related Art

Flat panel display devices include liquid crystal display devices (LCD) which are being used widely, plasma display panels (PDP), and field emission displays (FED) which have been studied recently and may be applied to computers in the near future. For convenience of explanation, the present invention will be discussed with respect to the LCD as an example of the flat screen type display devices and a portable computer mounted with the LCD.

Referring to FIG. 1, a general portable computer such as a laptop or notebook computer typically includes a body 100, a flat panel display device assembly 110 coupled to the body 100 via a hinge mechanism 124. The flat panel type display device assembly 110 has a flat panel display device 111 and a display case 122 supporting the flat panel display device 111. The body 100 has an input device 102 such as a keyboard. As a flat panel type display device 111, the LCD is widely used in portable computers and flat screen monitors.

Referring to FIG. 2 which shows conventional assembly structure of the LCD device applied to a conventional portable computer, the display case 122 has a rear case 123 and a front case or frame 121 for mounting the LCD device 130. The rear case or frame 123 has an outer surface and an inner surface and connecting ribs 123a are formed at the corners.

The LCD device 130 has an LCD panel 132, a backlight device 134 fixed to the back of the LCD panel 132, and a supporting frame 136 for assembling the LCD panel 132 and the backlight device 134 along the edge.

At the corners of the supporting frame 136, corresponding to the positions of the ribs 123a of the rear case 123, a plurality of protrusions 136a having holes are formed.

For mounting the LCD device 130 to the display case 122, the LCD device 130 is placed on the rear case 123 and the holes of the supporting frame 136 and the ribs 123a are fastened together preferably by screws 138. The front case 121 is coupled to the rear case 123.

Hereinafter, the way in which the LCD device is mounted to the case from the front toward the rear direction is defined as the front mounting method, and the assembled structure of the LCD device and the case formed through the front mounting method is defined as the front mounting structure.

In the front mounting structure of the LCD device, since the protrusions 136a require additional space corresponding to the protruded width d, the display area of the LCD device is reduced in comparison to the fixed size of the display case 122.

The front mounting structure may also include an additional feature to further support the LCD device panel, as shown in FIGS. 3A and 3B.

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Referring to FIGS. 3A and 3B, a conventional LCD device assembly 110 includes an LCD panel 112 and a backlight device (not shown) for the LCD panel 112, and display case 122 supporting the LCD device 111. The LCD panel 112 and the backlight device are assembled by a supporting frame 114 along the edges.

The display case 122 is coupled to a body 120 via a hinge mechanism 124, which may extend from the body 120. The display case 122 and the hinge mechanism 124 are assembled through a hinge arm 126, allowing the flat panel display device assembly 110 to pivotally move with respect to the body 120.

Two opposite sides of the supporting frame 114 include flanges 114a for assembling the LCD device 111 to the display case 122, and corners include flanges 114b for assembling the LCD device 111 to the hinge arm 126. Hereinafter, the former is referred to as a fixing flange and the latter is referred to as a mounting flange in this specification for distinction purposes. As shown in FIG. 3B, the fixing flanges 114a have a protruding width d2 and the mounting flanges 114b have a protruding width d1. A screw hole is formed in each of the flanges 114a and 114b. On the inner surface of the display case 122, ribs 122a are formed corresponding to the holes of the fixing flange 114a.

To mount the LCD device 111, the hinge arm 126 and the mounting flanges 114b are screwed together, and the fixing flanges 114a and the ribs 122a are screwed together by bolts 128.

In the mounting structure shown in FIG. 3B, the supporting frame 114 requires side spaces for the flanges 114a and 114b. Therefore, the side space D ($d1+d2$) results in a reduction of the display area of the LCD panel 112 relative to the display case 122. Moreover, as the display size increases, the display case becomes undesirably large, especially for a portable computer such as a laptop computer.

To solve the above problem and to provide a large display area with minimal display case size, a new mounting structure is needed for the LCD device.

SUMMARY OF THE INVENTION

Accordingly, the present invention is directed to a portable computer and method for mounting a flat panel display device thereon that substantially obviates one or more of the problems due to limitations and disadvantages of the related art.

An object of the present invention is to minimize the non-display area of the LCD device.

Another object of the present invention is to provide a computer having a flat panel display device with a maximum display area and a minimal display case size.

Additional features and advantages of the invention will be set forth in the description which follows, and in part will be apparent from the description, or may be learned by practice of the invention. The objectives and other advantages of the invention will be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described, a portable computer includes a body having an information input device; a case coupled to the body and having inner and outer surfaces; and a flat panel display device having a display surface and a rear surface, the rear surface being fixed to the inner surface of the case.

According to another aspect of the present invention, a portable computer includes a body having an information

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input device; a flat panel display case coupled to the body; a flat panel display device having a display surface and a rear surface; and a hinge mechanism having a hinge mount and a hinge arm fixed to the rear surface of the display device.

According to another aspect of the present invention, a method of mounting a flat panel display device to a hinge mechanism having a hinge mount, a hinge arm, and a pin portion rotating in the hinge mount, the flat panel display device having a display surface and a rear surface, the method including a step of fixing the rear surface of the flat panel display device to the hinge arm. The fixing step is preferably carried out by attaching the hinge arm and the rear surface of the flat display device using a screw.

According to a further aspect of the present invention, an LCD device coupled to an outer case includes an LCD panel having a display surface and a rear surface; a backlight device having a first surface facing the rear surface of the LCD panel and a second surface attached to the outer case; and a supporting frame for assembling the LCD panel and the backlight device.

It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

In the drawings:

FIG. 1 is a perspective view showing a general portable computer;

FIG. 2 shows a conventional mounting structure of the LCD device for a portable computer;

FIGS. 3A and 3B are a perspective view and a front view, respectively, showing a mounting structure of the LCD device for a portable computer;

FIGS. 4A-4C show the LCD device according to a first embodiment of the present invention;

FIG. 5 shows a mounting structure in accordance with a first embodiment in accordance with the present invention;

FIG. 6 shows a mounting structure in accordance with a second embodiment in accordance with the present invention;

FIG. 7 is a partial sectional view showing the assembled state of the structure in FIG. 6;

FIG. 8 is a perspective view showing a back mounting structure of the LCD device according to a third embodiment in accordance with the present invention;

FIG. 9 is a perspective view showing a back mounting structure of the LCD device according to a fourth embodiment in accordance with the present invention;

FIG. 10 is a front view showing the structure of FIG. 9;

FIG. 11 is a fifth embodiment in accordance with the present invention which is an alternate embodiment to FIG. 10 where the hinge mount is fixed to the display case;

FIGS. 12, 13, and 14 are sixth, seventh, and eighth embodiments in accordance with the present invention;

FIG. 15 is a side view showing a back mounting structure of the LCD device according to a ninth embodiment of the present invention; and

FIG. 16 is a partial sectional view showing the assembled state of the structure in FIG. 15.

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DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Reference will now be made in detail to the preferred embodiments of the present invention, an example of which is illustrated in the accompanying drawings.

The present invention provides a back mounting method and a back mounting structure for a panel display device in a portable computer. Moreover, the rear surface of the display panel device may be coupled to a hinge arm for further support of the display panel device.

FIGS. 4A-4C show a first embodiment of the present invention. Referring to FIGS. 4A and 4B, the LCD device 10 has an LCD panel 12, a backlight unit 14, and a supporting frame 16. FIG. 4C shows an example of a detailed structure of the LCD device 10 shown in FIGS. 4A and 4B. Referring to FIG. 4C, the LCD device 10 has a first frame 14g, preferably made of plastic, a reflector 14f on the frame 14g, a light guide film 14e, a diffuser or protecting film 14d, a first prism sheet 14c, a second prism sheet 14b, another diffuser or protecting film 14a, and the LCD panel 12. The first frame 14g is coupled to a second frame or supporting frame 16. At each corner of the first frame 14g a screw hole 15 is preferably formed. Although FIG. 4C shows the first frame 14g as part of the backlight unit 14, the first frame 14g can act as the supporting frame 16.

To mount the LCD device 10 to the display case 30 (FIG. 8), the LCD device 10 is placed on the inner surface of the display case 30. Then, the case 30 and the LCD device 10 are attached to one another by bolts 18 (which may be referred to as fastening elements, fastening parts, or a similar conveniently descriptive term) into the screw hole 15 (which may be referred to as a fastening hole or a similar conveniently descriptive term, and which together with the material defining the hole may be referred to as a fastening element or fastening part) from the back of the display case 30.

As explained above, the structure shown in FIGS. 4A-4C has an advantage in that the side space such as width d2 for fixing flange 114a of FIG. 3B is not needed and the size ratio between the display area and the display case is improved.

FIG. 5 shows the assembly of the LCD device 10 to the display case 21 of a portable computer according to a first embodiment of the present invention. The computer includes a body 20 or first section having an information input device and a second section including the case 21. The case 21 may cover the body 20 and is coupled to the body through a hinge mechanism. Together, the case 21 and the body 20 may be referred to as a housing, or a similar conveniently descriptive term. Preferably at each corner of the case 21 a through-hole 21a (which may be referred to as a fastening hole or a similar conveniently descriptive term, and which together with the material defining the hole may be referred to as a fastening element or fastening part) is formed.

To mount the LCD device 10 to the case 21, the LCD device 10 is placed on the inner surface of the case 21 such that the positions of the holes 21a and the holes 15 coincide with each other, and screws 18 (fastening elements or fastening parts) are inserted into the holes 21a and 15 (which may be referred to as fastening holes or a similar conveniently descriptive term, and which together with the material defining the holes each may be referred to as a fastening element or fastening part) from the back of the case 21. The through-hole 21a is preferably a stepped hole so that the head of the screw 18 will not protrude from the outer surface of the case 21.

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Although not shown in FIG. 5, a front case such as shown in FIG. 2 is preferably assembled with the display case 21 for covering the edges of the LCD device 10.

FIG. 6 shows a back mounting structure of the LCD device according to a second embodiment of the present invention, and FIG. 7 is a detailed partial sectional view showing the assembled state of the LCD device 10 and the case 21 in accordance with the second embodiment.

At the rear surface of the backlight device 14 of the LCD device 10, fasteners 17 (fastening elements or fastening parts) such as hooks made of plastic are formed, and the case 21 has corresponding ribs 23 (also fastening elements or fastening parts). Preferably, the ribs 23 do not protrude over the width of the supporting frame 16. A rib 23 has a stepped hole 21b. The fastener 17 is supported and latched by the stepped portion of the hole 21b. To facilitate the disassembly or release of the fastener 17 from the hole 21b, the hole is preferably a through-hole extending all the way to the outer surface of the case 21. The hole 21b may be covered by a cover 21c.

The fastener 17 has a compressible head which compresses into a small diameter to allow the fastener to enter and slide through the hole 21b. Once the head reaches the stepped portion, the head returns to its original diameter and snaps or latches onto the stepped portion of the rib 23. In order to disassemble or release the LCD device 10 from the case 21, a pair of tweezers or similar tool can be adapted for compressing the head of the fastener 17 from the back of the case 21 through the hole 21b. The fastener 17 is unlatched and can freely slide out of the hole 21b. As an alternative embodiment, the fastener 17 can be formed on the case 21 and the stepped hole can be formed at the rear face of the LCD device 10 to achieve similar results.

FIG. 8 is a perspective view showing a mounting structure of the LCD device according to a third embodiment of the present invention. There may be one or more hinge mechanisms for the LCD device; however, for convenience of explanation, only one hinge mechanism will be explained.

Referring to FIG. 8, a body 20 includes a hinge mount 22, where a hinge arm 24 is connected. The hinge arm 24 has a pin portion 24a and a flat or extended portion 24b. The former is for being mounted to the hinge mount 22, and the latter is for being coupled to the rear surface of the LCD device 10. The various hinge components may be separate pieces of attached members or a single structure.

The flat portion 24b can be elongated in various directions and by various methods. FIG. 8 shows one example of the flat portion 24b which is in the shape of an inverted "F" having a first support member extending in one direction and a second support member extending in a second direction substantially perpendicular to the first direction. At each end of the flat portion 24b, a hole such as a through-hole 24c (which may be referred to as a fastening hole or a similar conveniently descriptive term, and which together with the material defining the hole may be referred to as a fastening element or fastening part) is preferably formed. At the back surface of the LCD device 10, pegs 15a having mounting holes formed therein are formed corresponding to the positions of the through-holes 24c. The pegs 15a together with the mounting holes formed therein may be referred to as a fastening element or fastening part and as shown in FIG. 8 protrude away from the LCD device 10. The through-holes 24c are preferably screw holes. In the display case 30, a hole such as a through-hole 30 (which may be referred to as a fastening hole or a similar conveniently descriptive term, and which together with the material defining the hole may

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be referred to as a fastening element or fastening part) may be formed. Moreover, although hole 30a may be formed at the corresponding position of the through-hole 24c of the flat portion 24b, alternatively, the flat portion may be in an inverted "L" shape.

To mount the LCD device 10, the body 20 (first portion) and the display case 30 (second portion) (collectively referred to as a housing) are connected by the pin portion 24a on the hinge mount 22. The display case 30, the hinge arm 24 (referred to as a display device support member), and the LCD device 10 are preferably attached together by screws 18 (fastening elements or fastening parts) through the mounting hole of the pegs 15a and the screw hole 24c. Alternatively, nails or other similar known fastening elements or fastening parts can be adopted for this purpose.

Referring to FIGS. 9 and 10 which show a fourth embodiment of the hinge arm 24, the flat portion 24b of the hinge arm 24 is extended upwards and preferably extended to almost the entire height of the LCD device 10. In the flat portion 24b according to this embodiment, it is preferable to form a mounting hole 24c and the through-hole 30a at the same position. It is also possible to form the holes 24c and 30a at different positions relative to the display case. Thus, additional mounting hole 15a may not be necessary for this embodiment. The mounting structure of this embodiment may be stronger than that of the second embodiment. The LCD device 10, the elongated hinge arm 24, and the display case 30 are fastened together by screws 18, for example.

FIG. 11 shows a fifth embodiment of the present invention, where the hinge mount 22 is preferably fixed to the display case 30, but a fixed flange 26 is secured to the body 20. The structure of the hinge arm 24 and other elements are similar to those shown in FIGS. 9 and 10.

FIGS. 12-14 show three alternative embodiments of the embodiments shown in FIGS. 9 and 11. In FIG. 12, the sixth embodiment of the present invention, the hinge arm 24 has a shape of the letter "E." In FIG. 13, the seventh embodiment of the present invention, the hinge arm 24 has the shape of the letter "C." In FIG. 14, the eighth embodiment of the present invention, the hinge arm 24 has the shape of the letter "H." The fastening holes may be formed at various positions on the hinge arm 24 as desired to secure the hinge arm to the display case 30. Combinations and other variations of these different embodiments are contemplated in the present invention with the purpose of supporting the LCD panel, preferably through the back of the LCD panel and the case. For example, the seventh and eighth embodiments may be combined to provide a stronger support of the LCD panel. Moreover, the hinge mount may be fixed to the body 20 (FIG. 10) or the display case 30 (FIG. 11) in these embodiments.

The present invention contemplates the use of fastening devices other than screws. One such alternative embodiment is shown in FIGS. 15 and 16.

FIGS. 15 and 16 show the mounting structure according to a ninth embodiment of the present invention. At the rear surface of the LCD device 10, at least one fastener (fastening element or fastening part) such as a hook 19, preferably made of plastic or other suitable material, is formed. As can be seen from FIGS. 15 and 16, the hook 19 protrudes away from the LCD device 10 and includes a first part and a second part where the first part is larger than the second part. In the flat portion 24b of the hinge arm 24 (referred to as a display device support member), at least one corresponding through-hole (which may be referred to as a fastening hole or a similar conveniently descriptive term, and which

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together with the material defining the hole may be referred to as a fastening element or fastening part) is formed. In the display case, at least one stepped hole 30b (which may be referred to as a fastening hole or a similar conveniently descriptive term, and which together with the material defining the hole may be referred to as a fastening element or fastening part) corresponding to the through-hole in the hinge arm 24 is formed to support and/or latch the fastener 19. To facilitate the disassembly or release of the fastener 19 from the hole 30b through the rear of the case 30, the hole 30b is preferably a through-hole.

To assemble the LCD device to the hinge arm 24 and display case 30, the hinge arm 24 is mounted to the hinge mount 22 (as shown in FIGS. 10 and 11) and the through-hole 24c (see FIGS. 12-14) of the hinge arm 24 and the hole 30b (see FIGS. 15-16) are coincidentally placed. Then, the LCD device 10 with at least one fastener 19 is pressed into the hole 30b and latched onto the display case 30, as shown in detail in FIG. 16. Here, the fastener 19 will slide through the hole 30b and snap into place by the protruding or wing portions of the head of the fastener 19. To disassemble the LCD device 10 from the display case 30, a device such as tweezers or other suitable tool can be adapted for squeezing the head or top portion of the fastener 19 from the back of the case 30 through the hole 30b. The fastener 19 is unlatched and can freely slide out of the hole 30b. The hole 30b can be covered by a cover 30c.

Alternatively, the fastener 19 can be formed on the case 30 and the stepped hole can be formed at the rear face of the LCD device 10 to achieve similar results.

As explained above, the mounting method according to the present invention does not require unnecessary side space for mounting the LCD device on the computer. Thus, the ratio of the display area of the LCD device to the display case can be improved and maximized.

In the above embodiments of the present invention, although the LCD device has been used as one type of flat panel display device, other flat panel display devices such as plasma display panels (PDP) and field emission displays (FED) may be used in accordance with the present invention. Moreover, in the above embodiments, other hinge mechanisms may be used such as a gear hinge as disclosed, for example, in U.S. application Ser. No. 08/937,801 filed on Sep. 25, 1997 entitled, "DISPLAY WITH GEAR TYPE HINGE," which is incorporated herein by reference.

It will be apparent to those skilled in the art that various modifications and variation can be made in the portable computer and method for mounting a flat panel display device thereon of the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention cover the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

What is claimed is:

1. A portable computer comprising:

- a housing including first and second sections, the first section having an information input device and the second section having a case having a first fastening element;
- a rear mountable display device including a second fastening element at a rear surface of the rear mountable display device, the case and the rear mountable display device being attached through the first and second fastening elements;
- a hinge coupling the first and the second sections to each other; and

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a display device support member having a third fastening element, the display device support member being attached to the rear mountable display device through the third fastening element.

2. The portable computer according to claim 1, wherein the display device support member is attached to the rear mountable display device through the first and third fastening elements.

3. The portable computer according to claim 1, wherein the display device support member includes:

- a first support element extending in one direction; and
- a second support element extending in a second direction.

4. The portable computer according to claim 3, wherein at least one of the first and second support elements includes a fastening hole.

5. The portable computer according to claim 3, wherein the display device support member has a shape of letter "F".

6. The portable computer according to claim 3, wherein the first support element is substantially perpendicular to the second support element.

7. The portable computer according to claim 1, wherein the display device support member includes an arm extending upward.

8. The portable computer according to claim 7, wherein the arm extends at adjacent edge portions of the second section.

9. The portable computer according to claim 7, wherein the arm extends substantially to a top portion of the second section.

10. The portable computer according to claim 7, wherein the arm includes a fastening hole a portion of the arm, the rear mountable display device being attached to the arm through the fastening hole of the arm.

11. The portable computer according to claim 7, wherein the arm has an "L" shape.

12. The portable computer according to claim 7, wherein the arm has a "C" shape.

13. The portable computer according to claim 7, wherein the arm has an "E" shape.

14. The portable computer according to claim 7, wherein the arm has three sections forming an "H" shape.

15. The portable computer according to claim 1, wherein the hinge is in the first section of the housing.

16. The portable computer according to claim 1, wherein the hinge is in the second section of the housing.

17. The portable computer according to claim 1, wherein the first fastening element includes a fastening hole.

18. The portable computer according to claim 1, wherein the second fastening element includes a fastening hole.

19. The portable computer according to claim 1, further comprising a screw attaching the rear mountable display device to the second section through the first and second fastening elements.

20. The portable computer according to claim 1, wherein the first and second fastening elements include first and second fastening holes, respectively, and further comprising a screw, the screw attaching the rear mountable display device to the case through the first and second fastening elements.

21. The portable computer according to claim 1, wherein the display device support member is coupled to the hinge.

22. The portable computer according to claim 1, wherein the first fastening element includes at least one fastening hole located at a corner of the second section.

23. The portable computer according to claim 22, wherein the first fastening element includes at least two fastening holes at two corners of the second section.

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24 The portable computer according to claim 22, wherein the first fastening element includes four fastening holes at four corners of the second section.

25 The portable computer according to claim 6, wherein the second fastening element includes at least one fastening hole located at a corner of the rear mountable display device corresponding to the fastening hole of the first fastening element

26 The portable computer according to claim 9, wherein the second fastening element includes at least two fastening holes at two corners of the rear mountable display device.

27 The portable computer according to claim 9, wherein the second fastening element includes four fastening holes at four corners of the rear mountable display device.

28 The portable computer according to claim 1, wherein the first fastening element and the second fastening element include a screw hole, and a screw is inserted from the rear of the case to fasten the case to the rear mountable display device.

29 The portable computer according to claim 28, wherein the screw hole of the case is located at a position corresponding to a display area of the rear mountable display device

30 A portable computer comprising:

a housing including first and second sections, the first section having an information input device and the second section having a case having a first fastening element;

a rear mountable display device including a second fastening element at a rear surface of the rear mountable display device, the case and the rear mountable display device being attached through the first and second fastening elements;

a hinge coupling the first and the second sections to each other;

a display device support member including an arm extending upward and a third fastening element, the display device support member being attached to the rear mountable display device through the first and third fastening elements;

wherein the arm includes a fastening hole at a portion of the arm, the rear mountable display device being attached to the arm through the fastening hole of the arm;

wherein the first and second fastening elements include first and second fastening holes, respectively, and the rear mountable display device is attached to the case through the first and second fastening elements using a screw; and

wherein the display device support member is coupled to the hinge.

31 The portable computer according to claim 30, wherein the second fastening element is not visible from a viewing direction of the rear mountable display device.

32 The portable computer according to claim 30, wherein no fastening element is visible when viewed from the viewing direction of the rear mountable display device.

33 The portable computer according to claim 30, wherein the second fastening element includes protruding portions protruding away from the rear mountable display device.

34 The portable computer according to claim 33, wherein the protruding portion includes a peg having a fastening hole

35 A rear mountable flat panel display device capable of being mounted to a data processing device, the flat panel display device comprising:

a backlight unit including a first frame having a fastening part at a rear surface of the first frame, a flat display panel adjacent to the backlight unit; and

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a second frame;

wherein the flat display panel is between the first frame and the second frame, the first frame of the backlight unit capable of being fixed to a housing of the data processing device through the fastening part at the rear surface of the first frame.

36 The rear mountable flat panel display device according to claim 35, wherein the fastening part includes a fastening hole.

37 The rear mountable flat panel display device according to claim 36, further comprising a screw attaching the first frame of the backlight unit to the second frame through the fastening hole.

38 The rear mountable flat panel display device according to claim 36, wherein the fastening part includes at least two fastening holes at two corners of the first frame.

39 The rear mountable flat panel display device according to claim 36, wherein the fastening part includes four fastening holes at four corners of the first frame.

40 The rear mountable flat panel display device according to claim 35, wherein the backlight unit comprises:

a reflector unit adjacent the first frame;

a light source unit adjacent the reflector unit; and

a light guide unit adjacent the light source unit.

41 The rear mountable flat panel display device according to claim 40, further comprising a diffuser unit and a prism unit

42 The rear mountable flat panel display device according to claim 35, wherein the fastening part is not visible from a viewing direction of the flat display panel.

43 The rear mountable flat panel display device according to claim 35, wherein the flat panel display device only shows the flat display panel and the second frame when viewed from a viewing direction of the display panel

44 The rear mountable flat panel display device according to claim 35, wherein the fastening part includes a protruding portion protruding away from the flat display panel.

45 The rear mountable flat panel display device according to claim 44, wherein the protruding portion includes a peg having a fastening hole.

46 The rear mountable flat panel display device according to claim 44, wherein the protruding portion includes a first part and a second part, the first part being larger than the second part.

47 A rear mountable flat panel display device capable of being mounted to a housing, the rear mountable flat panel display device comprising:

a backlight unit including:

a first frame having a fastening part at a rear surface of the first frame;

a reflector unit adjacent the first frame; and

a light guide unit adjacent the light source unit;

a flat panel display adjacent to the backlight unit;

a second frame; and

a screw attaching the first frame of the backlight unit to the second frame through the fastening part;

wherein the flat panel display is between the first frame and the second frame, the first frame of the backlight unit capable of being fixed to the housing through the fastening part at the rear surface of the first frame.

48 The rear mountable flat panel display device according to claim 47, further comprising a diffuser unit and a prism unit

49 The rear mountable flat panel display device according to claim 47, wherein the fastening part is not visible from a viewing direction of the flat display panel.

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50. The rear mountable flat panel display device according to claim 47, wherein the flat panel display device only shows the flat panel display and the second frame when viewed from a viewing direction of the display panel.

51. The rear mountable flat panel display device according to claim 47, wherein the fastening part includes a protruding portion protruding away from the flat display panel.

52. The rear mountable flat panel display device according to claim 51, wherein the protruding portion includes a peg having a fastening hole.

53. The rear mountable flat panel display device according to claim 51, the protruding portion includes a first part and a second part, the first part being larger than the second part.

54. The rear mountable flat panel display device according to claim 47, wherein the fastening part includes a fastening hole

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55. A rear mountable flat panel display device comprising:
a first frame having a fastening part at a rear surface of the first frame;

a second frame; and

a flat display panel between the first and second frames; wherein the first frame is capable of being fixed to a housing of a data processing device through the fastening part at the rear surface of the first frame.

56. A rear mountable flat panel display device comprising:
a first frame having a fastening part at a rear surface of the first frame;

a second frame; and

a flat display panel between the first and second frames; wherein the first frame is capable of being fixed to a housing of a data processing device through the fastening part at the rear surface of the first frame and the flat display panel is rear mounted.

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